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Limit Gaging -

Can an International System Be Established?

By John Gaillard

Mechanical Engineer, American Standards Association

ONE OF the most important standardization problems in the mechanical industry is the establishment of a national system of fits from which each branch, unless its requirements are very special, may select the fits required for its particular purpose.

Standard fits are indispensable for mass production of interchangeable parts. Interchangeability may be required merely by the assembly of the component parts into the final product; by the necessity of replacing worn or broken parts; or by the fact that it must be possible to connect members of one group of objects to those belonging to another group, as for example, in the case of taper-shank tools and the spindles of the machines in which they are to be used.

The first of these conditions may exist either in a single manufacturing concern only, or between different concerns manufacturing simple component parts, or more complicated sub-assemblies of the same final product. For example, spark plugs and ball bearings are supplied to automobile builders in large quantities by concerns specializing in their manufacture. Such service requires agreement between the parties concerned, both on the nominal dimensions of the parts in question, and on the degree to which they may be permitted to vary from the nominal dimensions. Thus arises the necessity of establishing manufacturing limits for every dimension of a part that is essential in connection with the fit between that part and another, the distance between the limits representing the manufacturing tolerance.

This need for standard fits has spread from the individual concern to the branch industry, and through groups of interrelated industries to national industries. It thus has come about that up to the present time national standard systems of fits have been established in eleven countries, while such standard systems are in course of development in five other countries.

Evidently, the problem is more than nation-wide. In this age of highly-developed mechanization and international commerce, it is important to the whole industrial world. In fact, while the necessity of agreeing on international uniformity of certain nominal dimensions of particular technical products was recognized years ago, the refinement of many products, including more perfect fits between their component parts, makes it necessary to agree, internationally, on uniform nominal dimensions and on uniform manufacturing limits. In recognition of these requirements, the British-standard Whitworth (coarse) thread and the British-standard pipe thread have been adopted by ten other countries besides Great Britain. (See *American Machinist*, July 28 and Aug. 4, 1927.)

National standard systems of fits are established in eleven countries and are in development in five more. The author makes some comparisons, and analyzes some of the steps that must be covered to attain a universal system for all countries

The case of ball bearings shows clearly what can be attained under the pressure of technical necessity. Up to the present time, three series of radial ball bearings (light, medium and heavy types) have been established and are internationally uniform as to their main nominal dimensions (bore, outside diameter and width), while unification of the tolerances on these dimensions is now under way. Difference in the customary unit of length (inch or millimeter) is no obstacle in this respect. For example, the proposed American tables give the tolerance on the outside diameter of 52 mm. (2.9472 in.) of bearing No. 205 as being 0.0006 in., equaling about 0.015 mm., or 15 microns, while the metric countries give the tolerance on the same dimensions as being 15 microns.

The first part of the article. The second will appear in an early issue.

Another example of a standard that has been adopted in several countries for the purpose of securing proper fitting between products made abroad and those made in the home land, is that for the taper shanks of tools, which govern their fit in the spindles, or collets, of the machines in which they are to be used. Several European countries have adopted the Morse taper, for the reason that the considerable number of machine tools and cutting tools with taper shanks imported by those countries, require cross-interchangeability with such machines and tools as are manufactured in the home countries.

It is not to be wondered, therefore, that the question has arisen as to whether the several national systems of fits in existence, or in the making, could not be merged into one general international system. Ten definitive national standards were in existence on the first day of April, 1929, five of which are entirely, or essentially, the same as the German system. Holland is now revising its original system, and is included in this count.

In April, 1926, during an international conference on standardization between representatives of eighteen national standardizing bodies, held in New York upon the invitation of the American Engineering Standards Committee (now the American Standards Association), the question was raised as to whether or not international uniformity in the matter of fits could be attained in principle. The conference on this subject was attended by representatives of the sectional committee on "plain limit gages for general engineering work" organized under the procedure of the American Engineering Standards Committee (now the American Standards Association), under the sponsorship of the A.S.M.E. This committee has worked out a Tentative American Standard on "Tolerances, allowances and gages for metal fits" approved in 1925.

The question was discussed at a conference of technical experts and was answered in the affirmative. It was decided later that the problem would be investigated by collecting data on all of the national standard systems of fits, either established or in course of development. The German national standardizing body (Deutscher Normenausschuss) agreed to function as the secretariat for this international work. In July, 1928, this body published an exhaustive report on the situation in German and English. Copies were sent to all of the national standardizing bodies, inviting them to co-operate in the work and to comment on the report, or to submit suggestions or criticisms. A copy on file in the office of the American Standards Association (29 West 39th St., New York) may be consulted by those interested in the subject.

The report on "Limits and fits" of the international secretariat deals with seven principal items, as follows:

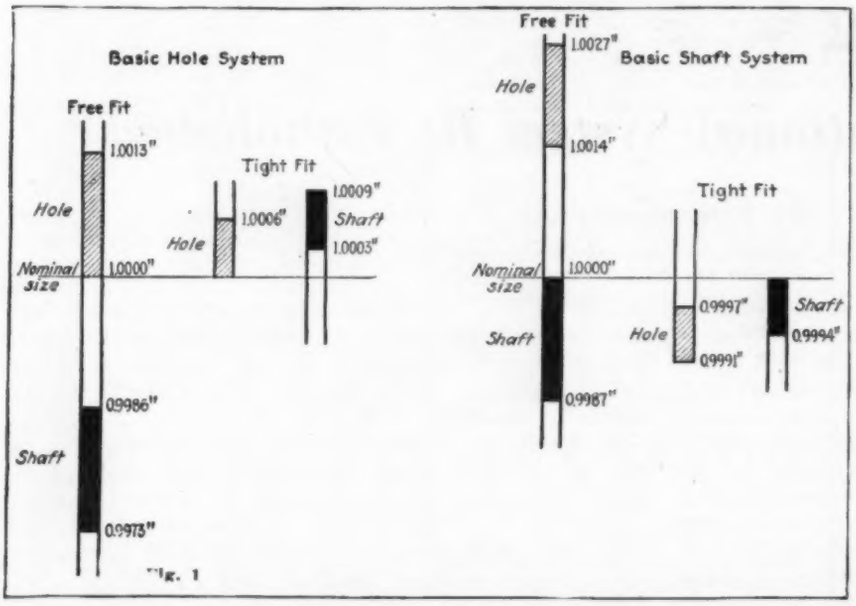

Fig. 1

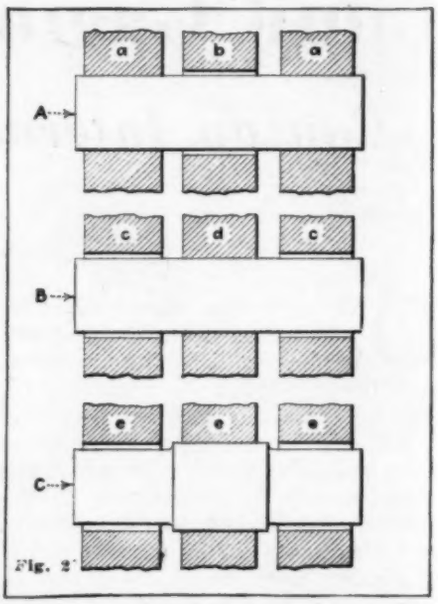

Fig. 2

Fig. 1—Limits for equivalent "free" and "tight" fits in "basic hole" and "basic shaft" systems. Fig. 2—Influence of arrangement of several fits on the same shaft, the choice between "basic hole" and "basic shaft" systems

Reference temperatures. "Basic hole" and "basic shaft" systems. Bilateral and unilateral tolerances. Classes of fit; grades or qualities of fits. Basic structure of the national standards. Manufacturing limits and permissible wear of gages. Symbols for the designation of fits. The findings laid down in the report are given in abstract below, each finding being preceded by a brief discussion of the principle involved, for better understanding of the significance of the results of the investigation. The data given in the report of the German secretariat, issued July, 1928, have been brought up to date to March 1, 1929, through information on the latest developments supplied by K. Gramenz, chief engineer on the staff of the German national standardizing body.

A definitive national standard on fits has been adopted in the following countries: Austria, Belgium, Finland, Germany, Great Britain, Holland (standard of 1920 now under revision), Italy, Norway, Sweden, Switzerland and the United States. Proposed standards were under discussion in: Czechoslovakia, Denmark, Poland and Russia, while in Japan the work is still in course of development. In France and Hungary, no proposed standard systems of fits, as worked out under the auspices of the national standardizing body, is as yet under consideration; however a standard reference temperature has been adopted in these countries (zero C. in France and 20 deg. C. in Hungary).

The reference temperature is the temperature at which the dimensions of a product are supposed to be measured. Consequently, it is also the temperature at which gages used for the inspection of products are supposed to have their "nominal" sizes, that is, the sizes of those manufacturing limits of the products which the gages must check.

If a limit gage has exactly the same coefficient of expansion as that of the part with which it is to be inspected, it makes no difference at what temperature the inspection takes place. However, when the coefficient of expansion of the gage and that of the part to be inspected are different, a comparison between their sizes at one temperature would give a result different from that of a comparison at another temperature. For example, if the size of a steel gage and that of a part made of brass are the same at zero C., the gage will appear to be smaller than the part when the temperature of both has been raised to 20 deg. C., the reason being that steel expands less than does brass for an equal increase in temperature. Assuming that the coefficients of expansion of brass and steel are 0.0000184 and 0.0000115 per deg. C., respectively, a brass and a steel part having nominal lengths of 4 in. and showing no measurable difference in size at zero C., will show a difference of about 0.00055 in. (0.014 mm.) when their temperature has changed to 20 deg. C. In many cases this difference is too important to be neglected. For example, the tolerance on a shaft having a diameter of 4 in., for an American standard snug fit (class 4), is 0.0006 in., a value only about nine per cent greater than the temperature difference for parts of the same nominal size between zero and 20 deg. C. Therefore, agreement on the temperature at which the parts are supposed to be gaged is a fundamental requirement of any standard system of fits.

The Influence of Temperature

The influence of temperature difference has, of course, a direct practical importance in cases where the parts manufactured and gaged at room temperature, operate at a much higher or lower temperature when assembled in the machine or apparatus to which they belong. The former condition applies, for example, to the piston pin of an automobile motor; the latter condition to certain component parts of refrigerating machinery. An extreme case was reported some time ago by a military aviator who had found, when flying at an altitude of about 37,000 ft., where the temperature was 60 deg. C. below the freezing point (76 deg. F. below zero), that the throttle of his motor could not be moved because of excessive shrinkage of certain levers forming part of the controlling mechanism.

The reference temperature of 20 deg. C. (68 deg. F.) has been adopted by the following sixteen countries: Austria, Belgium, Czechoslovakia, Denmark, Finland, Germany, Holland, Hungary, Italy, Japan, Norway, Poland, Russia, Sweden, Switzerland and the United States. The reference temperature in Great Britain is 62 deg. F. (16⅔ deg. C.), while in France it is zero C. (32 deg. F.). France is, however, contemplating a change to such reference temperature as will be internationally adopted. The British Engineering Standards Association recommended, in January, 1929, in a letter to the British engineering industry, that the standard reference temperature be changed from 62 to 68 deg. F. (20 deg. C.) for the sake of international uniformity. The indications are that this recommendation will meet with a very favorable reception. With a view to its already wide national adoption, the reference temperature of 20 deg. C. has evidently a fair chance of becoming the international standard.

In specifying the manufacturing limits for each of the two mating parts, in order to lay down their respective tolerances and the nature of their fit, the first requirement is a reference line in relation to which the positions of the four limits (two for each part) may be determined. A simple method that has become common practice, consists in the adoption of the *nominal size* of the parts as such reference line. Whatever may be the nature of the fit between two parts having a nominal size of 1 in., the value of 1.0000 in. is adopted as the point of departure.

The nominal size may be adopted as the low limit of the hole, independently of what may be the tolerance on that hole and the nature of its fit with the shaft. The smallest permissible size of any hole of a certain nominal size, is then the nominal size itself. The size of the hole thus remains constant, or "basic" (if we disregard its tolerance), while the size of the shaft is varied to give the required fit. This system is therefore called the "basic hole" system.

The high limit of the shaft is selected in connection with the minimum clearance or the maximum interference desired for the fit under consideration. Finally, the two remaining limits (the high limit of the hole and the low limit of the shaft) are determined by the tolerance to be given on each part. To illustrate this by a concrete example: A "free" fit and a "tight" fit between a 1-in. hole and a 1-in. shaft, in the American standard ("basic hole") system, are defined by the following limits:

		High limit	Low limit
Free fit ("basic hole" system)	Hole	1.0013	1.0000 (nominal size)
	Shaft	0.9986	0.9973
Tight fit ("basic hole" system)	Hole	1.0006	1.0000 (nominal size)
	Shaft	1.0009	1.0003

The shaft could be kept "basic" instead of the hole, by adopting the nominal size of the mating parts as the high limit of the shaft, independently of its tolerance and the nature of its fit in the hole. This would be the "basic shaft" system. The three remaining limits would be selected by the same reasoning as applied above to the "basic hole" system. The "free" fit and "tight" fit defined above in the "basic hole" system, would have the following limits when translated into the "basic shaft" system:

		High limit	Low limit
Free fit ("basic shaft" system)	Hole	1.0027	1.0014
	Shaft	1.0000 (nominal size)	0.9987
Tight fit ("basic shaft" system)	Hole	0.9987	0.9981
	Shaft	1.0000 (nominal size)	0.9984

The two fits are given in diagrammatic form in Fig. 1, in both the "basic hole" and the "basic shaft" systems. It is evident that there is no difference whatever in the nature of the free fit in the "basic hole" system and that in the "basic shaft" system. In fact, although there is a difference in the positions of the tolerances on the two parts with regard to the reference line, there

is no difference in the values of these tolerances, nor in their positions relative to each other.

Incidentally, it may be observed that the variation in looseness or tightness of a fit, as governed by the allowance and the tolerance on the parts, may be reduced by so-called selective assembly. This matter will be dealt with more in detail in the part of this article where "grades," or "qualities," of fits are discussed.

No general decision can be taken as to whether the "basic hole" or the "basic shaft" system is the most practical one to use. In many cases, the choice between the two systems requires very careful consideration of all the factors involved in the manufacture of the product concerned, such as the quality of finish of its component parts, the number of parts produced per unit of time, the process by which the parts are machined, the number and the kind of tools and the limit gages required, etc. The choice between the two systems may even depend, in the last instance, upon factors still more involved than those just mentioned. For example, the question of different fits to be used for several parts arranged on the same shaft, and the sequence in which these fits occur from one end of the shaft to the other. In Fig. 2, examples of such fits are given.

Diagram *A* shows a running fit arranged between two tight fits on the same shaft, the shaft being a piece of cold-rolled steel requiring no machining. The difference in fit is due to the difference in size between the holes *a* and *b*. At *B* the tight fit, *d*, arranged between two loose fits *c*, would not be desirable on a shaft of uniform diameter, because the pressing of the part *d* on to the shaft would spoil the surface of the shaft for one of the running fits *c*. Therefore, application of the "basic hole" system, as shown at *C*, becomes necessary. In this diagram, the diameters of the three holes *e* may be the same, while the diameter of the shaft is made larger in the center than at the ends, to give the desired fits.

In general, it can be said that it is easier to change the size of the shaft, especially where modern grinding methods are used, than to change the sizes of the holes, which would require the use of different, or adjustable, reamers. This would seem to indicate an advantage in favor of the "basic hole" system. On the other hand, however, certain industries can make use of large quantities of cold-rolled steel bars. The tolerance in such bars is so close and the finish is so good that they can generally be used without machining.

In such cases, the "basic shaft" system will very likely be more economical to use than will be the "basic hole" system, unless certain combinations of fits on the same shaft make the use of the "basic hole" system preferable. The problem is, therefore, rather a complicated one, and cannot be dealt with in further detail here. However, the fact may be cited that of the two largest electrical manufacturing concerns in Germany, one (Siemens Schuckert Works) uses the "basic hole" system, while the other (German General Electric Company) uses the "basic shaft" system.

Making Good Use of the Cost System

By Harry Kaufman
Public Accountant

With a good system of general accounting, the manufacturer can ascertain at the close of each fiscal period the amount of his total profit or loss. If the books show a profit, he may be satisfied, even though it is small. If, however, a loss has been suffered, the books may not be in such detail as to enable him to ascertain the cause, nor the way to prevent future losses.

Unless prices in the trade are rising, the remedy of increasing his selling price is not open to him, since he must meet the competition of fellow manufacturers. In order to determine whether or not he can continue to manufacture his various articles profitably, he must have a system which will show the costs and profits of his different products. A general accounting system will not do this; a cost system will. With a cost system the manufacturer can concentrate his efforts on manufacturing and selling the more profitable lines, and at the same time be able to reduce his costs through the knowledge given by the detailed figures.

General figures may be misleading. A concern, as a whole, may be making satisfactory profits, yet some departments may have to carry the losses of others. If a good cost system is installed, such conditions will be disclosed. A manufacturer, to be sure, may maintain some departments at a loss, simply because of their service or advertising value. He should do so, however, with his eyes open. Such a policy can be controlled intelligently only when actual costs are known.

One of the important items in a cost system is that of repairs. From an accounting standpoint, repairs are defined as expenditures which are necessary to keep assets in normal operating condition. In many instances special purchases must be made of repair parts which are never carried in stock, nor is it desirable to carry them. Material of this nature should not be charged to an inventory account; instead it should be charged directly to the standing expense order affected by the purchase.

On each request for a purchase of this nature, the entry for charging the account should give the standing expense order covering repairs on that particular piece of equipment for which the material is desired. The accounting department should then enter this invoice as a debit against the expense ledger account, and make out an expense debit slip chargeable to the standing order number.

Too much stress cannot be laid on the importance of settling, at the time of the purchase, the destination of a repair charge, because puchases of this nature have probably caused more trouble in cost accounting than any other class. If the procedure here outlined is followed, it is not difficult to account properly for all the incoming material, as far as the records are concerned. In addition, the receiving clerk is given information which will enable him immediately to deliver these repair parts to the master mechanic's department in order to get the crippled equipment into operation. Repairs should therefore be treated in the accounts as an operating expense, and should appear in the expense estimates of the various departments.

High-Speed Lathe-Tool Tests

LATHE tools under shallow cuts and fine feeds may be tested by a new method developed by the U. S. Bureau of Standards, based upon the fact that when two tools are set at equal depths in one tool holder the second or "trailing" tool will not cut until the "leader" or cutting tool begins to wear. With the carbon and high-speed steel tools used, the second tool began to cut when the leader had worn 0.001 to 0.002 in., and at this point the leader or test tool was considered to have failed. All subsequent comments on turning with shallow cuts and fine feeds are based on this end point, but greater wear can be made to represent tool failure by using a shallower setting for the second tool than for the cutting tool.

Tests were made dry at different cutting speeds, feeds, and depths of cut on nickel steel forgings with tensile strengths of 80,000 to 100,000 lb. per sq.in., to give a broad background for the interpretation of the results of tests of different tool steels, first heat-treated.

Effect of Cutting Fluids

In tests of short duration, where tool failure occurred in about 2 to 10 min., the tool life was increased somewhat more by the use of water than by lard oil, but in tests of about 50 min. duration, under the same feed and depth of cut but lower cutting speeds, these two liquids produced effects of the same magnitude. The increases in tool life from the use of these liquids were not large in any case, but the finish on the work at the end of the cut was better with the liquids than without.

Tests with tools of different forms and angles showed that the successful application of the described method of test was not dependent upon having the broad-nose tool used in a majority of the experiments. Tools with a plan angle of 65 deg. had a longer life than the broad-nose tools, but the finish produced on the nickel steels in dry turning did not appear to be as good. The best tool life with the broad-nose tools was obtained with a back slope of 30 deg.; a side slope of 0 deg. was better than 8 degrees.

The cutting speed of quenched carbon-steel tools was not affected appreciably by variations in carbon content from 0.75 to 1.3 per cent nor by subsequent tempering at temperatures up to 375 deg. F., which did not lower the hardness. The cutting speed of carbon steel tools was lower in all cases than that of high-speed tools but the differences between the two decreased with decrease in the areas of cut in dry turning.

Cobalt, up to about 5 per cent, improved the performance of the high-speed steel tools both under shallow cuts and under heavy duty, but the maximum benefits were obtained only with high hardening temperatures. Replacement of part or all of the tungsten in high-speed steels by molybdenum, in the ratio of 1 part molybdenum to 2½ parts of tungsten, produced steels having performance comparable to that of the tungsten steels. Such substitution should be useful in case of a depleted tungsten supply, but is not advocated at the present time because of hot-working property irregularities of molybdenum steels.

The addition of 3.75 per cent of nickel to the customary chromium-tungsten-vanadium steels was beneficial for the rough-turning tools, particularly when combined with a 50 deg. F. increase in the hardening temperatures, but was detrimental to the tools used under shallow cuts and fine feeds, and adversely affected the machining properties of the high-speed steel itself.

Each of the four elements, arsenic, antimony, copper, and tin adversely affected the tool performance of high-speed steels under shallow cuts, the magnitude of the decrease becoming greater as the proportions of these elements increased. Copper was the least harmful; next in order came tin, while arsenic and antimony were the most objectionable. Phosphorus up to about 0.06 per cent and sulphur up to 0.215 per cent did not appear to be injurious, from the point of view of lathe-tool performance of the customary chromium-tungsten-vanadium steels, with or without cobalt. However, high sulphur tended to lower the cutting speeds in the presence of 3.75 per cent nickel.

Aluminum adversely affected the performance of the high-speed steel tools both with shallow cuts and under heavy duty. It was one of the few metals considered which, in proportions around 0.3 per cent, produced a measurable decrease in the cutting speeds in rough turning. Titanium appeared to lower the dissolving capacity of the austenite and as a result the hardness and the cutting speeds of the high-speed steel tools decreased with increase in the titanium. Its interference was lessened by increasing the carbon content of the steel in the tools.

Tantalum did not appear to be promising as a substitute for vanadium or as an alloying element in the customary chromium-tungsten, high-speed steels for lathe tools. It acted in a manner similar to aluminum and titanium in that it appeared to decrease the hardness and cutting speeds of the quenched lathe tools.

Abstract of a paper entitled "Testing Lathe Tools With Shallow Cuts at High Speeds" in the U. S. Bureau of Standards Journal of Research.

Men Over Forty-Five—*Discussion*

By A. W. Ainsworth
Wm. Ainsworth & Sons, Inc.

THE article by L. C. Newton on page 893, Vol. 70, of *American Machinist*, is to the point. Permit me to add that it is ridiculous to expect a man to have reliable experience who has not put in the early years of his life in training. The writer has tried several of these so-called high-pressure young men, and has found them lacking in the fundamentals of experience.

Our line of endeavor requires men who are not only well-grounded mechanically, but well-grounded scientifically. It takes at least fifteen years to acquire the necessary skill as a mechanic to be able to do our work properly, and the ability to carry on from there takes another long period. Thus, by the time a man begins to be able to carry out a proposition he is 45 years of age. Of course, if you want a high-pressure production man to tighten up nut No. 1,726, that is a different proposition. We have a man past 60 who can outwork, outthink, and outproduce any young man we have ever tried.

EXECUTIVE · FORUM

Exchanging Ideas on Shop Methods

"THERE'S a young chap in town who wants to publish our methods of making machines," said Joe Fenner to the table group at the Club, at lunch. "I'm flattered a bit that he thinks they are up to date, for he's one of the editors of a well-known paper, but I'm wondering just what I'll get out of it, and how much it will benefit my competitors in other towns."

"There he is at the second table, Joe," spoke up Bill Holland, "why not ask him over and see what he has to say for himself."

"I was just telling the boys," said Fenner, "about your visit this morning. Frankly, I'm glad you liked our methods but I'm not sure I want to broadcast them to any competitors. Why should I?"

"There are several ways of looking at that, Mr. Fenner," replied the scribe. "I've worked in the shop and ran a little place of my own for awhile. And the more I see of modern manufacturing methods the more convinced I am that shop secrecy is more or less a joke.

"If you built all your own machines and your men never left you, you might possibly keep secrets if you could keep everyone out of your shop. But when you admit visitors, as you do, and point with pride to some of your best fixtures and set-ups, your methods are about as private as a gold fish. And whether you allow visitors or not, any competitor who really wants to know your methods, can usually find out if he is willing to spend a little money. Not bribing your men, but planting a man in your shop. And they frequently hire a good man at a good salary to get the information."

"But why make it easy for them by letting you publish it, son. And of what interest are my methods to anyone not in my line?"

"I'll wager you come pretty near knowing how your competitor makes his product, that is if it interests you. And the chances are he knows all about yours already. Good mechanics anywhere are very apt to solve problems in much the same way. I've been sworn to secrecy in shops a thousand miles apart, both using identical methods and each thinking no one else had them.

"Then, too, Mr. Fenner, good mechanics get a lot of pointers seeing how others handle their work, even if it is different. A good man doesn't have to adopt a method whole, he gets a pointer and adapts it to his particular job."

"And you want me to contribute to their education as well as competitors? You haven't told me what I get out of it," and Fenner winked at Holland.

"Frankly, Mr. Fenner, you owe it to your industry to help us spread information about better machine methods. You told me this morning you got many suggestions from the technical papers. Isn't it up to you to do your share in helping things along by giving your experience?"

"But it has cost me real money, my boy."

"So does everything worth while, Mr. Fenner. And it hasn't cost you half as much as it would if others hadn't told you about their methods. You told me yourself this morning that you liked to have visitors who knew their job because you frequently got good suggestions from them. That's exactly what we do in the paper every week."

"How do you feel about it, Holland?" asked Fenner.

"Seems to me, Joe, that he's told the story pretty well. You get ideas from others through his paper and it's only fair that you should come across with some of your methods. There may be reasons for not publishing all of them, but it's just as apt to be because they are behind the times as ahead of it.

"One of my friends turned over a new leaf a few years ago and began showing people through his shop after keeping it closed for years. Now he's kicking himself because he finds that instead of keeping valuable information in his shop, he was keeping it out."

"Looks like I better let you get that article this afternoon," said Fenner turning to the scribe.

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

DISCUSSION

Discouraging Rush Orders

That the problem of pushing through rush orders can be handled effectively was proved some five years ago in a shop manufacturing special machinery. When there were signs of good times ahead, nearby manufacturing establishments would swamp our contract manager with orders for special machinery. Some orders requested delivery in the minimum period it took to make a machine, which, of course, interfered with the regular production program. But it was our business to meet these conditions, for the very life of our business depended upon it.

Our first step in solving the problem was to send out form letters to each of our old customers, and to possible prospects, requesting them to send us at their earliest convenience, when occasion warranted, details of possible machine purchases, so that we might be able to prepare for such orders. We then arranged our production program, allowing out of every month, a gap of one week in which rush orders were inserted, the plan being as follows.

At the beginning of each month we would take the orders received from the contract department, allot them to their proper places in the program and reserve the required openings for orders which were promised. If the promised orders did not come along at the stated time, the work scheduled beyond this period would be moved up a week. Thus at times our customers would receive their equipment sooner than expected. If an unexpected rush order came along, we would splice it in somewhere, and if our program were completed before the end of the month, we would move up work which was slated for the following month. By pursuing this course we were able to keep all promises within a certain period of time, cope with rush orders as they occurred, and keep our costs down to where they belonged.

—Fred A. Schmidt, *Industrial Engineer, Western Electric Company.*

Rewards for Suggestions

The suggestion box system is one of the best plans to interest employees in their work, to get money-making ideas for the company, and to make sure that the suggestor is properly rewarded for his suggestions. Even when there is no cash award, official recognition and proper credit mean a lot. If suggestions are rejected, they are at least on record, and can be referred to if necessary at any time to prove the source of the original idea.

In our organization, all suggestions are marked by number, and the names of the men submitting them are known only to the secretary of the suggestion committee, and are published only when suggestions are accepted. Awards are made in accordance with the value of the suggestion, except in the case of foremen and supervisors, who are not eligible for cash awards, but receive credit in the form of an entry on their record cards. These records are taken into consideration when increases in salary, or promotions to better positions, are to be made.

Promptness is imperative in acting on suggestions. If for any reason an extended investigation is necessary, the suggestor should be notified so that he will know his interests are protected.

The biggest part of a suggestion committee's job, that of rejections, is the most important of all. One poorly-worded rejection can make more enemies than a fifty-dollar award can remove. Tact and diplomacy are necessary, but facts that can be substantiated, if questioned, must be given in making the rejection. The reason why the suggestion cannot be accepted must be made perfectly plain and understandable to the suggestor.

—R. J. Morrison, *Asbestos, Que., Canada.*

Reducing the Scrap Heap

It is interesting to note that attention which was formerly concentrated on speeding up production is now being diverted to the scrap heap —one of the most expensive byproducts of too much speed. The methods of reducing it suggested by Bill Holland and his conferees are all good, and all have real possibilities.

One other very obvious way, which is often overlooked in the desire to get into production on a new model, is the "dog" job. It is always good practice to make up one complete assembly of any machine or product before going into production on the detail parts. Thus, the drawings are proved, and any unforeseeable contingencies are brought to light.

Another method is to organize a salvage committee, meeting daily to investigate spoiled work, and including representatives of production, inspection and engineering. Engineering can suggest acceptable modifications, inspection can recommend changes in tolerances, and production can suggest changes in design, that will lessen the possibilities of rejection in the future. Some changes in design may permit the spoiled work to be re-worked. When the job is in production, it is a fruitful source of redesign information, that unfortunately is often overlooked.

—William C. Wise.

A Novel Reward for Shop Improvements

I am quite willing to admit that the idea of patenting a worthwhile suggestion for the shop man possesses novelty, but I am afraid the manager is building up potential trouble for himself. In the first place, there is a pretty even chance that the shop man in question will not only get a swelled head, but also that his conception of the value of the patent will grow by discussion. So, woe betide the manager if he does

not succeed in selling it for what the shop man finally thinks it is worth. And if perchance he does not succeed in selling it at all, which also is quite possible, since the real struggle in any patent is not in getting it but in marketing it, his good intentions will be a veritable boomerang.

I greatly favor paying for a suggestion immediately, and thus closing the transaction definitely, as far as the shop man is concerned. I would favor doing this on the basis of a variable reward, which represents merely a bid for the idea. The shop man should be thoroughly informed that if he deems his idea worth more than the reward offered, he is free to take it elsewhere and offer it for sale.

After all, we too often prize highest of all the things we know the least about, and when it comes to a knowledge of the value of his idea, the shop man is likely to have an exaggerated conception of its worth. It is better to watch a man who shows ingenuity and initiative, to see how he stands up under publicity and success, with the thought of making promotion to a more important and better paying position his ultimate and greatest reward.

—A. MERRICK BLAMPHIN.

Hiring Men From Other Shops

Any agreement entered into between two or more people, or organizations, to hinder progress on the part of one or more individuals, or organizations, is certainly unfair, and savors of a majority in number and strength forcing an issue over a minority in number and strength.

The executive who will not willingly allow one of his men to accept from somewhere else a better position than he can give him, is so short-sighted that he will also hold any man in his employ at a task where he is making good, indefinitely. Such an executive either does not sense future needs, or he lacks courage to give a man an opportunity in his own organization, however promising the man may be. He thus makes impossible the building up of men in his own organization for the better positions, and, in this way, defeats the very plan which he should seek to promote, that is, to develop the key men and executives necessary to meet the future needs of his own plant. —JOHN MARK MAY.

Taking on a Side Line

Apart from certain jobs which are accepted with the distinct understanding that no sidelines are allowed, an executive has a perfect right to supplement his income in directions which do not clash with, or impair his service to, his employers. It is obviously a matter which a man's sense of fair play must settle to a certain extent. Thus to exploit his special knowledge of his firm's products or processes for competitive or private uses, is quite as dishonest as stealing the firm's property.

Many men, among them engineers, develop a genius in a particular hobby. In some cases the hobby, in time, proves more remunerative than the whole-time job. Unless the man has entered into an agreement as regards duration of service, he is at liberty to sever connections with his employer and devote himself to the hobby.

A directorship in one company is not held to be a barrier against directorship in others. Many leading men serve upon the boards of several important corporations. So, if a man's manner of supplementing his income neither hurts the firm he serves nor diminishes his own usefulness to that firm, he should be allowed freedom to develop along his own lines in the time which is his own. —W. R. NEEDHAM, *England.*

Getting Men from Other Industries

A wide experience is of great value to a shop superintendent and to his employer. Some of the most capable men I know deliberately left situation after situation in their youth to get work at other factories where something new or novel was manufactured. In one case, the man had experience in the turbine and engine department of a large shipbuilding and armament firm, after serving part of his apprenticeship in a railway locomotive shop. He then worked successively for testing-machine makers, pump makers, on machine tools, and in another railway repair shop. During the War he constructed and operated a government shell factory. Afterwards, he became shop superintendent of the gun-sight shop of another armament firm, the latter position an instrument-making job as far removed from locomotive-building as presses are from ice-cream freezers. Later, he joined the staff of a machine tool concern as works manager, and is now a director of the company. His advancement is evidence of the value of varied experience.

A man coming from a large plant to a smaller shop, of course, needs careful watching in regard to requisitions, at least for a short time. He may want to spend more than the company can afford. In a large shop, also, a superintendent generally has competent assistants on whom he can rely to carry out details of the work, with little supervision. In a smaller shop, assistants are not so numerous, and perhaps not so competent, because the salary scale is smaller. For example, the head storekeeper in a large firm must be a very capable man, and his position commands a good salary. He takes instructions from the superintendent and sees that his staff carries them out. In a smaller firm, the head storekeeper is a man who may compare with one of the assistants in a bigger plant, and perhaps requires detailed supervision. The superintendent used to a big shop may overlook this fact.

If a superintendent from another industry is vigilant on these points he is well worth a trial. If he proves adaptable, he will be a valuable asset. His varied experience will suggest successful methods unknown to the man who has been in a rut all his life, and the consequent economies and improvements in manufacturing methods will amply repay his employer.

—C. NORMAN FLETCHER, *Cheshire, England.*

Centralized Control of Heat-Treatment Processes

By Fred H. Colvin
Editor, American Machinist

An outline of the method used, beginning with the experimental heat-treatment, and showing how the work is handled and controlled

AN EXAMPLE of centralized handling of heat-treatment problems is to be found in the plant of the National Cash Register Company, Dayton, Ohio, where nearly 8,000 different parts receive some degree of treatment in the heat-treating department. Many of the parts that go to make up a cash register are subject to continuous stresses and wear, with the result that heat-treated alloy steels are being used for such parts as shafts, levers, yokes, and pins that drive the various mechanisms. In order to determine the best treatment for each part in the machine that requires it, the piece is first handled in an experimental heat-treating department, a section of which is shown in Fig. 1. Various methods of heat-treatment are tried and the results secured from them are checked for hardness, strength, impact, and endurance. When a satisfactory treatment has been decided upon, specifications are made out on a card arranged for the purpose, and a history of the piece itself goes on another card, both sides of which are shown in Figs. 2 and 3. This record carries a reference number by which all information concerning the part can be looked up in detail. The piece shown in Fig. 3 is to receive heat-treatment No. 72 and is to be further treated in accordance with specification No. 108. The piece is to be copper plated before machining, in order to confine the hardening to the machined surfaces. The illustration on the card is made with a rubber stamp and the surfaces to be hardened are outlined with red ink, and as the gear teeth and the cam faces are cut after the copper plating is done, only those surfaces will be hard. The cards illustrated in Figs. 4 and 5 show specifications for two operations. These cards together form a complete specification for the product.

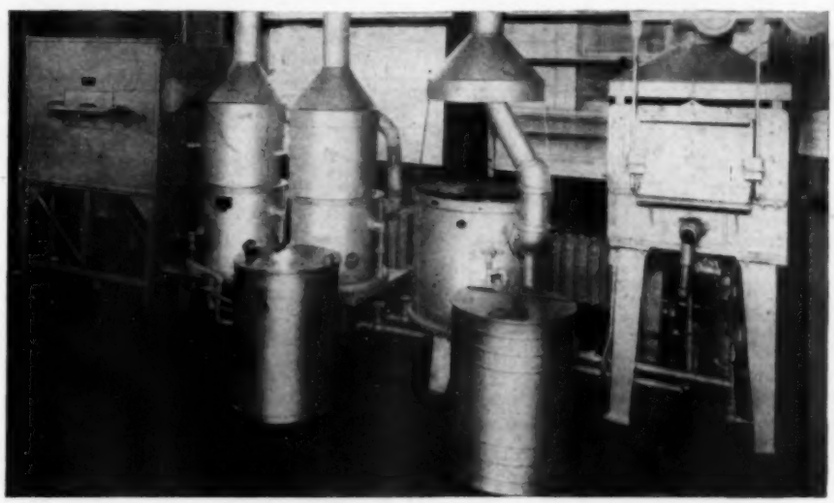

Fig. 1—Experimental heat-treating room where the proper heat-treatment is determined for each part. The equipment includes various types of furnaces, both gas and electric

When the untreated parts reach the heat-treating department they are entered on an individual record card, so as to give a continuous record of the part and also to enable reference to be made to the total number of the same part treated over a given period. The card used is shown in Fig. 6, the reference number before referred to being the designating figure. The entry shows that 270 pieces of the part shown on page 13,326 of the stock book came to the heat-treating department on 1-24-29 and were assigned to furnace No. 3. The next record is the heat-treating record, Fig. 7. This might be called a furnace record card as it shows the different lots treated in a given furnace at the same time, and, of course, to the same specification. In this case the specification is No. 45, the temperature called for is 1,500 deg. and No. 3 furnace is to be used. The number of pieces in each lot is seen in the second column. The packer and furnace man add their numbers when the work reaches them, and the time of starting and finishing is stamped at the bottom, so that these cards form a record of the heat-treatment given in any particular furnace. Any variation from the length of time named in the specification is shown by the times stamped at the bottom of the card. This record permits work to be traced through each operation, back to the man who did it. These cards are preserved for two years.

A method of tabulating the numerous heat-treatments in compact form is shown in Fig. 8. This table gives the number of the specification, the duration of the treatment, the temperature required and the quenching medium. The first two vertical sections are for standard furnace heats and treatments, while the last one demonstrates how miscellaneous treatments may be shown in a small space. These treatments include the use of salts, lead, cyanide, charcoal and saltpeter and show

The first part of the article. The conclusion will appear in an early issue.

Page No. 82224

Date 1-23 1929

Part Name 62000 Consecutive No
Pitman Gear #1

Heat Treating Specifications # 72

See other side for Sketch of Part - Red Portion to be hardened.

Remarks Harden as per specification #108
Copper plated

Approved by _____ Test Dept. _____ Heat Treating.

Fig. 2

Fig. 2—Heat-treatment work order and specifications

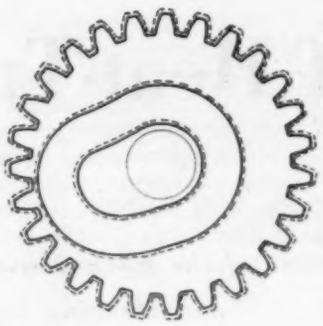

Fig. 3

Fig. 3—The back side of the card shown in Fig. 2 an outline of the piece to be treated is stamped on this side. The surfaces to be hardened are outlined in red

N. C. R. Heat Treating Specification # 72

Date 1-24 1929

Pack in NEW BONE 20% OLD BONE 80%

Heat in Furnace to 1600° F. Time 4½ hours

Quenched _____

Cool in Pot Yes

Reheat in _____ to _____ F. Quench in _____

Draw Temper to _____ F. Time _____

Remarks _____

Approved by _____

Fig. 4

Fig. 4—Heat-treating specification giving full directions for the packing, heating and cooling of all pieces that require treatment No. 72

Fig. 5—Another heat-treating specification that shows the second treatment specified on card in Fig. 2. These cards permit full instructions to be given, with little writing

N. C. R. Heat Treating Specification # 108

Date 1-24 1929

Pack in NEW BONE OLD BONE

Heat in _____ to _____ F. Time _____ hours

Quenched _____

Cool in Pot _____

Reheat in Cyanide to 1500° F. Quench in Oil

Draw Temper to _____ F. Time _____ Min.

Remarks _____

Fig. 5

Approved by _____

Page Number	Name of Part
13326	

Fig. 6

Date	1/25/29									
Amt.	220									
Date										
Amt.										
Date										
Amt.										
Date										
Amt.										
Date										
Amt.										

Fig. 6—Record card of similar parts showing the date, the number of parts and the furnace in which they were treated

Form 1422—E **The N. C. R. Record of Parts Heat Treated** Printed in U.S.A.

Platform No.	Truck No.	Furnace No.	Specification	Heat
		3	45	1500

Order No.	Amount	Check Numbers	
		Packer	Furn. Man
13326/21	220		
8162/35-6	606		
60774-35-1-9	686		
8162-W-16	172		

Commenced	Finished	Total Time	
		Hrs.	Min.
701	1101	4	1

Fig. 7

Fig. 7—Time card showing the work being handled by one furnace at the same heat. These cards give a complete record of the heat - treatment given

Spec. No.	Time	Temperature	Quench	Spec. No.	Time	Temperature	Quench	Spec. No.	Hardening Salts	Lead	Cyanide Pan	Furnace	Elec. Furnace	Charcoal	Saltpeter	Stop Welder	Torch	Quench	Heat to	Draw to	Time
1	4	1650	SO	46	Qu.	1500	W	101		x								W	1500		
2	4	1650	W	47	6	1550	SO	102		x								O	1500		
3	4	1650	O	48	4	1500	SO	103			x							W	1500		
4	3½	1650	SO	49	7	1650	SO	104				x	x					O	1475		
5	3½	1650	W	50	6	1650	SO	105					x								
6	8	1650	O	51	6	1650	W	106					x							550	Heat thru
7	3½	1650	SO	52	4	1500												W	1550-75		
8	3	16					O	133					x					SO	800		Heat thru
9					6	1600	O	134					x					SO	1000		H.T. 30 min.
		1500	O	80	Qu.	1500	SO	135					x					SO	1100		30 min.
36	2"	1500	W	81	5	1600	O	136	x									O	1500	775	30 min.
37	2"	1500	SO	82	T.W.	1375	SO	137					x					SO		450	Heat thru
38	2"	1500	O	83	T.W.	1375	O	138						x				SO		500	30 min.

Fig. 8—A compact method of listing various heat-treatments, and enabling them to be read at a glance. It can be varied to suit any condition

various other factors governing the heat-treatment of parts.

The entire heat-treating department is under the supervision of the control room shown in Fig. 9. This room is on a mezzanine floor and has a clear view, through windows on the opposite side of the room from that shown, of the furnaces and other apparatus in the department. Each furnace has its recording pyrometer so that a continuous record is always available as a check on every batch of work that goes through the department. Other records are also kept here, so that this control room is the headquarters for both past and present data on the heat-treatment practices of the plant.

This centralized control, which embraces experimental, testing and mechanical supervision, is a self-contained unit, being absolutely independent from the regular plant departments in the matters of engineering, checking the results obtained, and controlling its own production and processes.

Having described how the proper treatment for each piece is decided upon in the experimental department, the way in which it is recorded, and how the information is transmitted to the department, we are now concerned with the arrangement of the heat-treating department itself. The arrangement of the furnaces can be seen in detail on the floor plan of the department shown in Fig. 9 and also, to some extent, in the illustrations.

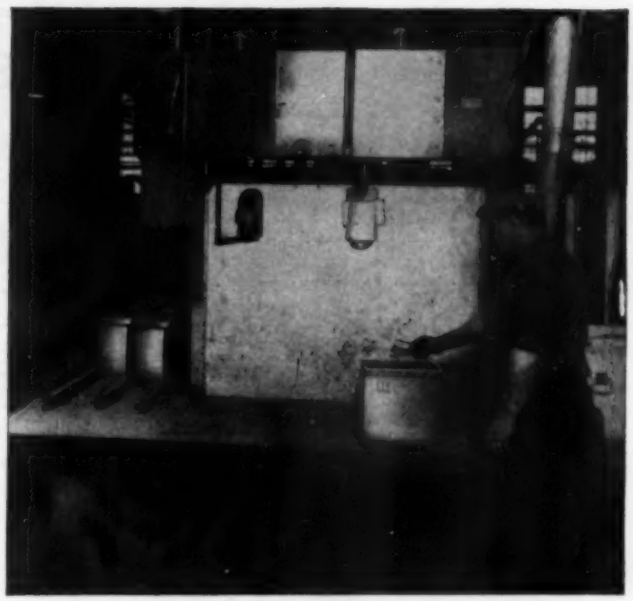

Fig. 10—Packing the boxes with parts to be carburized. The material for packing is mixed and delivered to the packing bench through the pipe at the right

Work to be carburized is packed at *A*, Fig. 11, on iron benches placed at a convenient height, as shown in Fig. 10. After the pots or boxes are packed they are slid along the bench to the roller conveyor at the left, beside the furnace. The reason for the double row of boxes, is so that they may be picked up by a crane, as will be shown later. The carburizing material, properly mixed, is supplied through the pipe at the right.

The electric carburizing furnaces are built with two heating elements one above the other, and each having an indicating lamp on top of the furnace as shown in Fig. 10. When starting a heat, both elements are switched in to bring the heat up quickly. When the designated carburizing temperature is reached, the upper element is automatically cut out and the heating continues with the lower element, throughout the carburizing period. The signal lamps on top of the furnace show whether one or both heating elements are in circuit and

Fig. 9—Furnace control room in heat-treating plant. This room is on a gallery, the other side overlooking the whole department. Each furnace has its own recording pyrometer

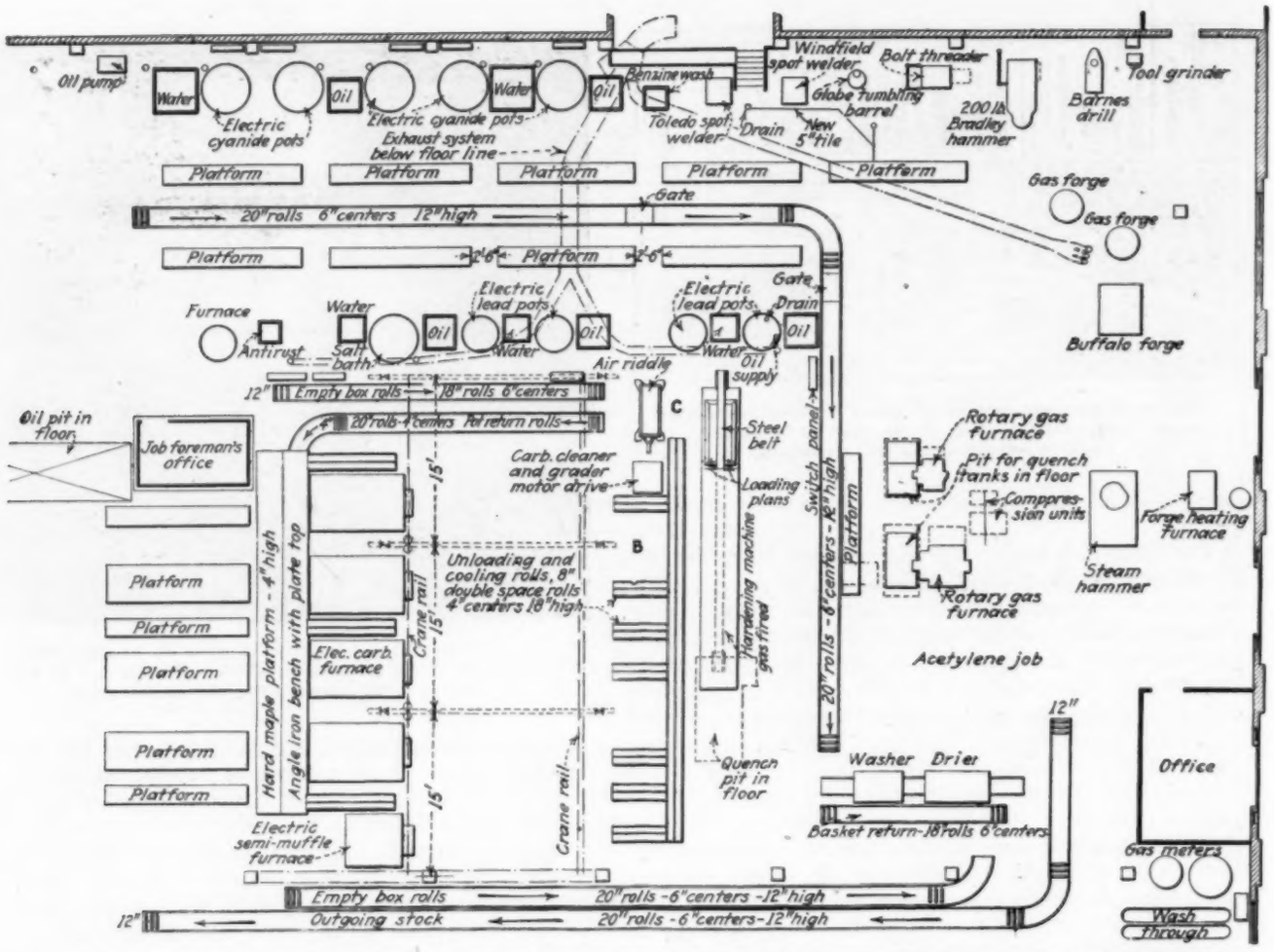

Fig. 11—Floor plan of the heat-treating department showing the location of the furnaces, the special crane for handling the carburizing pots, the automatic hardening furnace and other details

also when the furnace is "up to heat." This split element, as it is called, insures a thorough and uniform heating of the pots, as the lower half of the elements are located around the lower part of the furnace walls and under the hearth. It also helps the power house load, which is considerable, as each furnace is of 60 kw. capacity. The thermocouples are close to the pot and indicate the true pot temperature.

The Best Defense Against Communists—*Discussion*

By Harry Kaufman

COMMENTING on the editorial under the above title, on page 564, Vol. 70, No. 14, of the *American Machinist*, I believe that the chances of the professional agitator bringing about a strike in a plant where the working conditions are good, and the workers are satisfied that they are getting a square deal, are exceedingly remote.

But many employers have wondered at the readiness of the workmen to absorb destructive doctrines of radicalism preached by agitators, without once considering whether they have provided any truthful instruction to take the place of these doctrines.

The average industrial worker employs less mental effort at his daily task than did his ancestor in the handicraft period. But the normal man's mind does not lie idle; it keeps busy on something. It is only natural, therefore, that workmen will think about those things that are nearest to accustomed activities; home amusements, and conditions of employment. This is part of the reason for the prevalent curiosity of the more intelligent among the workmen in subjects related to economics, sociology, and government—a curiosity which has been seized upon with avidity by labor unionism and political and industrial radicalism, but of which employers are only just beginning to take advantage. The average workman wants desperately to know facts about wages, production, and profits, and about operation of the industry in which he is employed. He will be glad to secure these facts from his employer—always provided the conduct of the employer has been the kind which has inspired confidence—but if they are not forthcoming from that source, he will seek elsewhere for his information.

Industry cannot afford to leave to radical agencies instruction of workers in principles of economics and of business, for the result will be an astounding perversion of their viewpoints, with attendant danger to the community.

Oil Filtration on Machine Tools

By ALLEN F. BREWER
Mechanical Engineer, The Texas Company

Maintaining effective lubrication has a decided influence in lowering power costs, reducing wear on moving parts, and keeping machines in operation

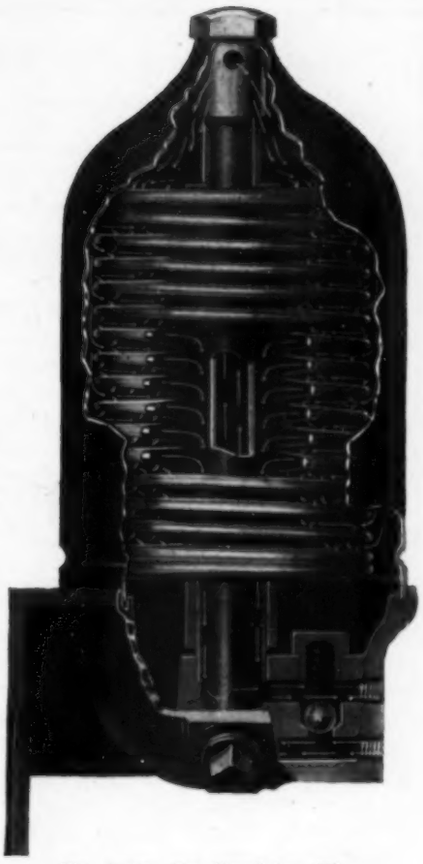

Fig. 1—In the Purolator filter, Type B—1, for machine tool service, the oil circulates downward over the filtering medium

IN THE development of equipment for mass production, builders of machine tools have given increasing attention to providing means for effective lubrication. Low-cost machine output is directly contingent upon maintenance of lubrication, which also has a most decided influence upon power consumption, wear, and continuance of operation.

Lubrication, to be positive and effective, calls for:

1. The use of lubricants of the highest degree of refinement.

2. Selection of lubricants to meet the operating conditions involved, such as pressure, speed and temperature.

3. Application of lubricants in a manner to insure maintenance of a continuous protective film on all wearing elements.

The user of machine tools will usually buy high-grade lubricants suited to his operating conditions. He must, however, apply these lubricants in accordance with the means provided by manufacturers of machines. Pressure systems have been extensively adopted for supplying lubricants to operating parts on the modern machine tool, due to the degree to which they insure maintenance of lubrication. Where oil circulation is involved, continual flow is extremely important.

With high-speed machines, lubricating oils must be most carefully guarded against contamination. Speed does not impose an abnormally severe load upon an oil, but it does require that there be no appreciable reduction in lubricating value, especially where bearings are involved. Should the lubricating film become impaired, serious consequences might result because of actual metallic contact between the rotating elements and their respective bearings.

The extended use of alloy steels, requiring higher cutting speeds, introduces further requirements of dependability into the design of machine tools. It is frequently more feasible to redesign machines than to reconstruct them. As a result, there is a tendency to develop machines of distinctive design where metals of this nature are to be worked. The higher the speed of the machine involved, the more necessary it becomes to provide adequate and reliable means for lubrication. The greater the cost and the more exacting the service expected of a machine, the more dependable must the lubricant be in performing its natural function. Hence, it is important to investigate the practicability of building means for oil filtration directly into the lubricating system.

In designing new equipment it is especially important to consider the filtering of lubricating oil. A circulating system of lubrication will require scarcely any alteration in design to provide for inclusion of an oil filter, and the extra initial cost will be virtually negligible.

Circulating a flood of lubricant under pressure is the best means of insuring positive lubrication when high rotating speeds are involved. In circulating, the oil serves not only as a lubricant, but also as a bearing coolant and clearance flushing agent. To serve this latter purpose effectively, it must be kept free from contaminating foreign matter.

The extent to which a filter maintains the initial purity of lubricating oil, will markedly affect the degree to which the machine can be depended upon to meet production requirements. Therefore, in view of the fact that higher speeds have been developed to increase production, lubrication must be more carefully protected to make possible the constant maintenance of these speeds. Bearing failure, due to faulty lubrication, will defeat the very objective which it is desired to attain.

Impairment of a lubricating film is caused chiefly by the presence of abrasive solid matter in the oil. In any machine there will always be a considerable amount of metal cuttings or dust around the operating mecha-

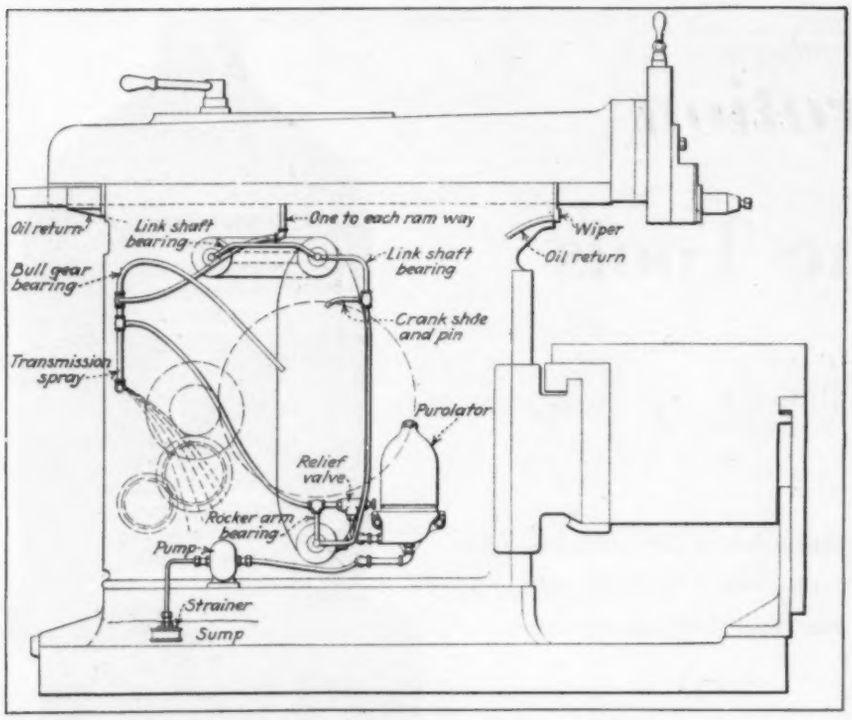

Fig. 2—A filter is installed as shown in the diagram in the pressure oiling system of the Rockford shaper

nism of the tool. The siliceous content of the dust will frequently be comparatively high. To guard against the entry of foreign matter machine tool drives are carefully housed. Pressure circulation of lubricating oil affords added means of protection. But dust-tight construction of all parts of a lubricating system is almost impossible. Therefore, added protection should be provided in the form of an effective oil filter.

Furthermore, bearing wear will take place in proportion to the degree in which metallic contact occurs. The presence of abrasive material within the clearance space will aggravate this wear. In the beginning, abrasive substances may have no appreciable effect upon operation, but if present to any extent they will impair the precision of the machine. Wear can be taken up by adjustment, of course, but it will involve time lost through shutdown of the machine. Ultimately, the bearings will have to be renewed. The damage is costly to repair, and is a detriment to production schedules.

The oil filter, as adapted to machine-tool service, has been designed for installation either as an original piece of equipment, or as an accessory part of an existing pressure-oiling system. It is capable of handling a comparatively large volume of oil; the Purolator, for example, having a flow rate of from 125 to 200 gal. of medium-viscosity oil per hour, depending upon the size of the piping. The usual practice is to install such a filter directly in the oil supply line on the pressure, or suction, side of the oil pump, according to the layout of the lubricating system.

With pressure lubrication, oil filtration is normally more effective than where splash or simple gravity circulation of the oil is involved. With these types of circulation, the effectiveness of the filtering medium is less, for it must be of such density, or mesh, as to permit the oil to flow through by the action of gravity alone.

Where oil is distributed under pressure, on the other hand, considerably more density in the filtering medium is possible, for the pressure exerted upon the oil will force it through, even after the filter has accumulated a lot of foreign matter. In fact, up to a certain point, the accumulation of foreign matter will aid the process of filtration.

Ultimately, however, the filter must be cleaned. The most effective way of cleaning such a device is actually to remove the element and wash it in gasoline or kerosene. Where a spring-type element is involved, it should be pressed together several times in order to loosen any accumulated dirt and enable penetration by the wash. The frequency with which the filter will require cleaning will depend, of course, upon the intensity of the service. On modern types of tools, where the oiling system is inclosed there will normally be less opportunity for foreign matter to enter, than on a machine where the filter may have been installed as an accessory.

On new, high-speed equipment, oil filters are often installed in duplicate, so that they can be by-passed alternately for cleaning, without shutting down the machine. This provision is of decided advantage where high production schedules must be maintained. After all, intensive manufacturing is

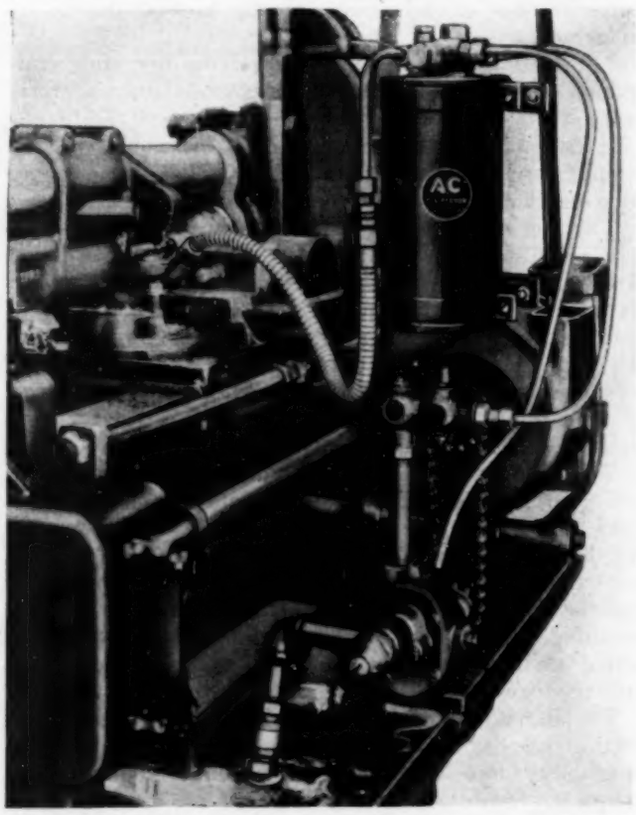

Fig. 3—Oil pumps and filters can be conveniently located on machine tools for pressure lubrication, as with this A. C. type, in which the lubricating system is external

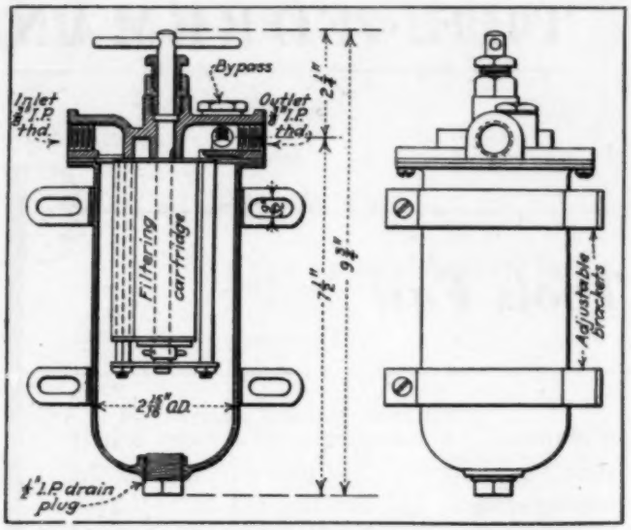

Fig. 4—A filtering cartridge, and cleaning by external operation of a handle, are features of the Cunofilter

possible only where lubrication is effective and the oil in circulation is kept clean.

The cost of protecting the lubricating system of a machine is so low, compared to the expense of shut-downs and repairs which it saves, that it is false economy to neglect the installation of a filter.

Porcelain Enameling Metal Parts

SEVERAL points in the above named article, which appeared in the *American Machinist* page 43, Vol. 71, were inadvertently omitted. The paragraphs refer to the parts after they go through an acid bath, and while still in the dipping basket, are placed upon a gravity conveyor which leads to the enamel dipping room shown in Fig. 3, page 44. Here, an operator removes them from the basket, dips them in the enamel and lays them upon an endless chain conveyor which carries them through another oven in which the water is evaporated from the enamel. On the return trip the conveyor is washed thoroughly to free it from the enamel that may have dripped on it. After going through the oven, the parts are removed from the conveyor and placed on racks which are taken to the enameling furnaces, by means of lift trucks.

The temperature required for fusing the enamel is 1,600 deg. F., and it is considered essential to use a fuel which makes possible a steady, even temperature. Otherwise the enameled surfaces produced will not be consistently good. In the Roper enameling plant, gas is used, as the company feels that it is the most satisfactory fuel for fusing porcelain enamel. Various other fuels have been tried but none has been found as satisfactory, from its point of view, as gas.

Each of the four furnaces shown in Fig. 4, is served by two loading carriages which roll on tracks in the floor. In removing a charge from a furnace, the upper section of the carriage slides from its base and is extended into the furnace under the charge of enamelware. It lifts the load and is then rolled out of the furnace onto the carriage. The other carriage, loaded with unburned enamelware is then rolled in front of the furnace, and charges it, so that little time is lost between unloading and charging.

SEEN · AND · HEARD

By JOHN R. GODFREY

Detecting Cracks by Magnetism Cleansing with Heat

PREVENTING failures of axles and similar parts by detecting cracks before they become dangerous, is a real problem. A time-tried method is to put kerosene on the suspected part, or wherever it is desired to test, then to wipe it off and apply a thin coat of whiting, which dries very quickly. A little kerosene soaks into the cracks and then seeps out through the whiting, indicating the location of the cracks.

While this seems to work well in most cases, there are cracks so fine that this test fails to give any indication. So some of the bright minds of the B.M.T. shops at Coney Island conceived the idea of using a permanent magnet and iron powder. They sprinkle a little iron powder on the axle and rub the magnet back and forth on the axle a few times. This results in collecting the iron powder in a definite way along the crack showing it up where the other method fails.

The answer seems to be that the steel becomes magnetized into north and south poles each side of the crack so that the iron powder acts as the keeper and collects between the two poles. Whatever the explanation, the plan seems to detect cracks that are too small to be found by the usual method, and so it becomes an added safeguard against accidents.

* * * *

I NEVER like to break off the old wheeze about there being "nothing new under the sun," first because it's a bromide, and next because it isn't true. We have had many things in my own time that are strictly new in the sense of being practicable for us to use. The ideas may have previously existed in the minds of different men, but they were never developed.

There are a few things, however, both in the way of machines and methods that had their actual beginnings a number of years ago. One of these is the throughly modern process of burning the dirt and grease from metal parts before enameling. This is now standard practice in many up-to-date enameling plants. And the idea may be entirely original with the makers of the huge continuous ovens for that purpose. But I found the same plan being used in a crude way in the St. Augustine shop of the Florida East Coast Railway a number of years ago.

Toward the close of the day it was the practice to load the forge shop furnaces with the connecting and side rods, valve motion rods, spring hangers and other parts stripped from locomotives in the shop for repairs. The furnace doors were closed and the parts allowed to remain all night. In the morning they were removed and the furnaces turned over to the forge crew. The parts removed were cleaned and the cost was confined to the handling of the work, since the heat would have been lost otherwise. It worked then as it works now on a larger scale and in continuous production.

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions given at the foot of the page have been prepared

THE · FOREMAN'S R

Why Some Tools Fail

"THERE'S something queer about that new cutting metal you were shouting about the other day, Al," said Ed, one evening on the way home. "Williams wanted me to try it out. Didn't stand up at all. Went to pieces in no time. And you thought it was great stuff, Al."

"Still do, Ed. I've had great results with it, but it's got to be used with judgment. You can't put it on any old machine and expect to get results. How did you use it?"

"Used it on the gap lathe, Al. It isn't much use with regular steel tools, so I thought I'd try and make it earn its keep. One of the new metal salesmen told me I could double the speed on any job and on any machine. But the tool went to pieces. And Williams was peeved. The old lathe was too strong for it. How do you use yours, Al?"

"Did you ever hear the story of the great painter who was asked how he mixed his paints and answered 'with brains, sir'? Well, that's how the new cutting tools have to be used, Ed. You're way off about the lathe being too strong for the tool. If it had been strong enough the tool would have given a good account of itself."

"I don't get that at all, Al. The tool broke—not the lathe."

"It broke because the lathe didn't hold the work or the tool firmly enough. You must remember the tool is very hard, almost like a diamond. Consequently it is more brittle than steel and vibration may easily affect the cutting edge. I'll bet the old lathe has a loose spindle, a weak tail stock, and the tool post wiggles in every joint—and there are too many joints. The work jumped, and the tool wasn't steady by a long ways. No wonder the tool didn't stand up; it didn't have a chance."

"Well, I'm not keen about tools that you have to nurse. Why isn't the old high-speed steel good enough?"

"Just because there's something better, for some work at least, Ed. But it's a great mistake to try and use the new tools in old machines that are ready for scrap.

"But if it means scrapping a lot of machines that we can use with the old tools, how can it pay, Al?"

"It's the *net* that counts, Ed. If the new cutting tools can cut machining time in half or even a quarter, it's just a matter of figures to show when to buy new machines so as to get the most out of the new tools.

"But can't you use the new tools in any old machine?"

"Of course, Ed. I'm using several of them. But I see to it that the machines are in as good shape as possible, and don't let the tool vibrate. On some jobs I save a lot by longer life between grinds at no increase in speed. In others they save both ways."

Is Al right in tracing tool failure to the machine?
Or is it because the tool was weak, as Ed contends?
Is speed or tool life between grinds most important?

All foremen are urged to discuss these questions vital to their work; of course the

'S ROUND · TABLE

DISCUSSION OF EARLIER TOPICS

Reporting Minor Accidents

IN ANY large factory the problem of preventing lost time accidents is a big one and every time one occurs it is an expensive experience. The idea of thinking that accidents "just have to happen" is a very poor one, for such thinking is liable to cause the careless action that results in the lost time accident. The accident under discussion was certainly the direct result of someone's carelessness and Ed is wrong when he says that the accident "did not amount to much anyway." All accidents cause loss of time for the one injured, loss of machine production and loss of money.

There are several good sized departments in this factory which have not had a lost-time accident of any kind for several years. The men in these departments are always on the alert to prevent them.

FRANK A. HYDE, *Timekeeper, Walworth Company, Kewanee Works.*

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Ed and Al Agree on Obsolescence

THE advantages of up-to-date equipment are obvious, but an up-to-date management will insist upon having a comparison between the old and new installations, so as to show efficiency as well as safety. Both are factors in competition. Of course, new methods mean new time study and new tools, in order to obtain full benefit of the new equipment. —SIGURD C. NIELSEN.

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Stirring Up the Foreman on Accidents

IN THE small shop the foreman must give personal attention to the prevention of accidents, but in the large plants a safety engineer should have direct charge of all activities connected with the health and safety of the worker.

The company can adopt certain set rules regarding guards, methods of handling and storing material and other safety regulations, but it is up to the foreman to give a personal touch to the safety campaign. Every worker should receive personal attention and be cautioned about such things as loose clothing, long loose neckties, the wearing of rings and other points not covered by company rules. —H. M. DARLING, *Engineer, Wells Tap & Die Company.*

Picking Men in Cheerful Surroundings

I BELIEVE there is a distinct advantage in picking men in cheerful surroundings. It inspires a favorable reaction on the prospect, for it makes him feel that here is a concern he would like to work for, because it thinks enough of him to make conditions pleasant. The right kind of man, who after all is the one you want to pick out from the long line of those who merely want a job, responds to such a stimulus. Many times the man who is most desirable slips by in an interview, because it is extended to him under such unfavorable surroundings that he isn't keen about your job, and reflects it to such an extent is his indifferent response to your interview, that you pass him up as an undesirable man.

The super, or whoever does the interviewing, also responds to the cheerful surroundings. If he interviews applicants in his regular office, where he is subject to constant interruptions by his regular duties and men bringing in difficulties to solve, he cannot concentrate properly on his interviews, which while they do not appear so urgent at the moment, really shape the future success of the plant. The interviewer appreciates the opportunity to give his undivided attention to the task in hand under pleasant surroundings, which permit him to go into applicant's qualifications thoroughly, while he at the same time is aided by a created desire on the part of the best men to want to pass a successful interview.

—WM. H. DONNER.

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Belts, Foremen and Paper Work

SOME years ago, I was connected with a large motor manufacturing industry. We were in competition with a number of other manufacturers, and each of them was trying to place its motors on the market at as low a price as possible. It meant that in order to compete successfully we had to save pennies wherever possible, and when a machine was laying idle, costs were piling up. Most of our machinery was run by overhead drives, thus requiring considerable belting. Our purchasing agent had been buying what I considered an inferior grade of belting. We employed a gang of beltmen who were busy all the time, taking up on slack belting or replacing it with new. As a general rule the belting on each individual machine would begin to slip every week or so, and it would then become necessary to shut the machine down, for at least a half hour, in order to correct it. This mean't that two hundred and fifty hours were being lost each week.

We tried to induce the purchasing agent to buy a better grade of belting, but he could not see the wisdom of doing so, and we therefore took the matter up with the factory manager. Upon his recommendation we worked up a system which proved the fallacy of purchasing cheap belting for the machines. Each foreman was given a folder which contained detailed blank forms pertaining to belting. The beltmen in each department were given small form pads on which was to be written the name of the machine, its number, the time spent in repairing the belting, whether new belting was used

discussion is not limited to foremen. Letters accepted and published will be paid for

or not, and the reason for the breakdown. These slips were handed in to the departmental clerk, whose duty it was to compile this information on the forms. At the end of each month the fully compiled sheet was handed over to the foreman who would check up each item carefully, make comments where necessary, sign it, and pass it along to the superintendent's office for further analysis and compilation.

Together with gathering this information, we made it our business to go out and purchase a number of different grades of belting, testing them out on the various machines, and keeping a separate record of each one. After a period we compared the experimental records with the standard records, and found that where the old belting would only stand up for a period of a year on an average, with a machine shutdown required each week to take up on the slack, the belting which we finally decided upon, although costing half as much again, would stand up successfully over a period of four years, with a machine shutdown only every three months, after the initial take-ups due to new belting being used.

—Fred Aug. Schmidt, *Industrial Engineer, Western Electric Company, Kearny.*

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Going Over the Super's Head

A MAN is placed in charge of a department with the expectation that he will get results with the assistance given him and the equipment supplied. At times he will become so disgusted with the way things seem to go against him that he will question the decisions of his immediate superior. When he finds himself in such a state of mind he should either get himself out of that condition or get another job. A foreman must hold his assistant strictly responsible for results, accepting no alibis for failure. If possible, he should keep such data as will show the facts regarding his ability. In this manner, the foreman will have something to show the superintendent, with more hope of having his plans accepted. But unless he is prepared to go job-hunting he should never go over his immediate superior's head, because, as a rule, he loses if he wins.

It is rather poor ethics to go over the head of a superior. Generally, executives are ordinary men actuated by the impulses common to everyone, so an attempt of this kind usually has bad results unless the one making it has unassailable proof that his stand is the right one. Unknown to him there may be good reasons back of a decision adverse to his own opinion or plans. Harmony among the plant personnel is one of the most important factors of successful business and it must be maintained regardless of who is sacrificed in order to do it. —L. O. Brown, *Toolroom Foreman, Holcomb and Hoke Manufacturing Company.*

IT IS unwise to make any official an autocrat however benevolent he may be, and while details may safely be left to individual judgment, all decisions of importance should be subject to the confirmation of an authority higher than the one making it. Though this confirmation may frequently be only a matter of form, it does give an opportunity for mistakes to be rectified before anyone's dignity is involved. If the "super" in question was known to be an "old fogy," any appointment which he proposes to make would naturally be scrutinized by the general superintendent with this in mind. A word or two on the telephone with Black would not take a couple of minutes and would disclose whether the matter needed to be gone into farther. The point of view of the superintendent and of the foreman on the appointment of an assistant foreman could be obtained separately and confidentially by the general superintendent whose decision would be made in the best interest of the firm. With the assistant already appointed, however, Black should have made the best he could of him. The best thing to do would have been to give him complete control of the section, so that his work would show his ability in his new position. —H. James, *Birmingham, England.*

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THE · NEXT · TOPIC

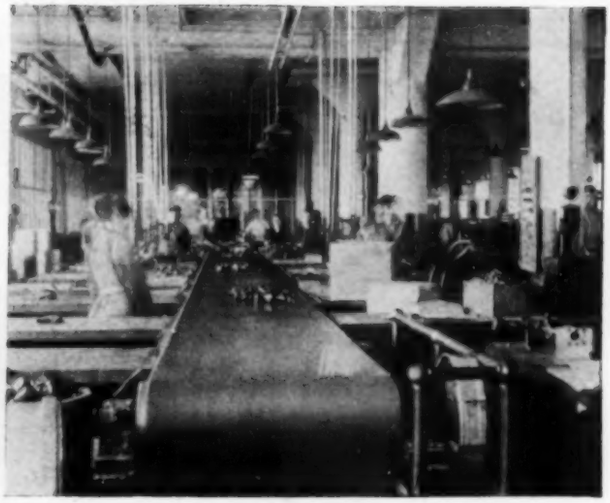
"Buying or Making Special Tools?"

Re-hiring Old Employees

SUMMARY OF THE DISCUSSION

Williams contemplated re-hiring Jack Thompson, who had been away for three years, and giving him a responsible position which was open. Ed believed that some man who has stuck by the firm should be promoted as a reward for loyalty. Al argued that sticking by the firm might also show lack of enterprise, and that the man who left had an advantage of broader experience.

OPINION was divided as to whether the experience acquired by Thompson in other shops was a more valuable asset to the firm than the loyalty of Wagner who had stuck to his job, and also as to what effect the re-hiring of Thompson would have upon the morale of the shop. One or two contributors suggested a compromise whereby Thompson should be re-hired at his former rating, and promoted later on. Another said that the temptation to hire an outsider was strong, but contended that loyalty should be paid for in something more substantial than compliments. An engineer stated that, although loyalty should be given the most careful consideration, it should not be confused with the lack of courage to step out and better one's condition. The one who remained should receive the promotion, all other things being equal, but he pointed out that in those places where promotion is fixed by seniority alone, many misfits occur because there is no incentive to learn more than just enough to hold one's job. A foreman expressed the opinion that entirely too much stress was being placed on long service with the idea of lessening labor turnover, and that a man, who, after remaining several years at one place, went elsewhere to improve his knowledge and then returned to his old shop, showed more loyalty than the one who remained on the job.



Two views of the assembling department showing how a belt conveyor forms the backbone of the layout

Chrysler Hydraulic Brakes

Their Design and Tools for Producing

By EDWARD C. LEE

Chief Tool Designer, Chrysler Corporation

THE HYDRAULIC-BRAKE system, as applied to the Chrysler automobile, consists of the following parts: A pump (called the master cylinder) attached to the left-hand side of the flywheel housing and carrying a piston that is connected to the brake pedal by a rod; four cylinders mounted on the brake supports between the brake shoes, one for each wheel, each cylinder containing two opposed pistons that press against the ends of the brake shoes; a supply tank attached to the dash; and a system of copper pipes running from the tank to the pump and from the pump to each of the brake cylinders, the connections between the pipes from the pump and the brake cylinders being made by heavy, non-expanding hose, especially made for the purpose.

The whole system is filled with a liquid composed mostly of castor oil and denatured alcohol. Added to the liquid are certain chemicals to neutralize any acids that may be contained therein. The function of the supply tank is to keep the system automatically filled with liquid at all times, replenishing any that may be lost through either leakage or evaporation. Also, to take care of expansion or contraction of the liquid, due to changes in temperature.

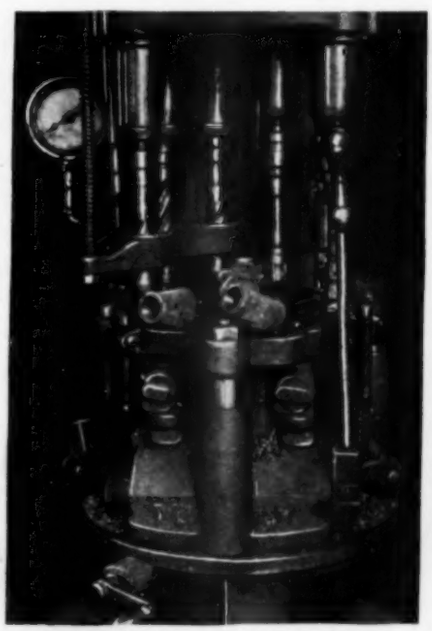


Fig. 1—Core drilling reaming the bores of the brake cylinders. An allowance from 0.008 to 0.010 in. is left for grindin.

In operation, depressing the brake pedal causes the piston of the pump to move forward and expel sufficient liquid to set up a braking pressure, through the copper pipes, in the brake cylinders to which they are connected. The pressure thus generated acts upon the pistons in the brake cylinders, forcing them outward and bringing the brake shoes into contact with the drums. Operating under the physical law that pressure exerted upon a body of liquid is expended equally in all directions, the pressure in all the brake cylinders must be the same, consequently, the pressure of the brake shoes upon the drums must be equal in all four cases. Upon release of the pressure of the foot on the brake pedal, the pistons in the pump and in the four brake cylinders are brought back to their original positions by springs, thus releasing the brakes.

It will be understood that having to withstand considerable pressure, the bores of the pump and the brake cylinders must be free from all blow-

- The first part of the article. The conclusion will appear in an early issue.

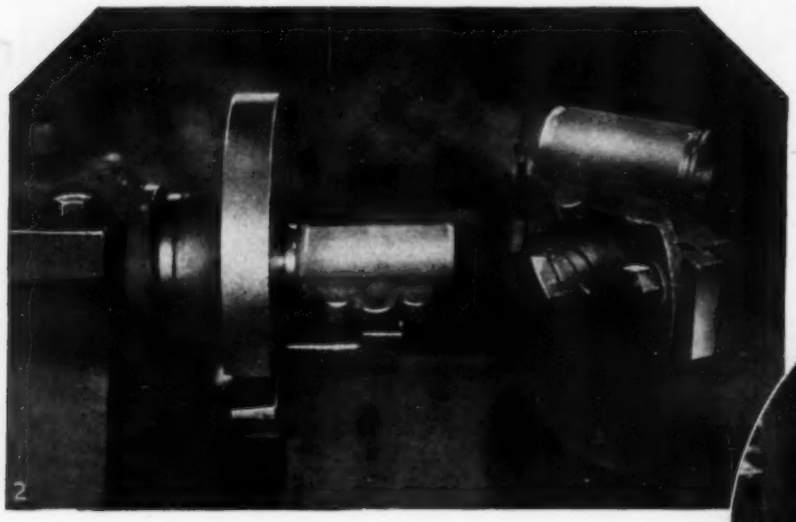


Fig. 2 — Facing and grooving the ends of brake cylinders. The grooves are for holding in place the rubber protectors, which keep out the dirt. Both operations are performed in a lathe at one setting. Grooving is done by a circular form-tool

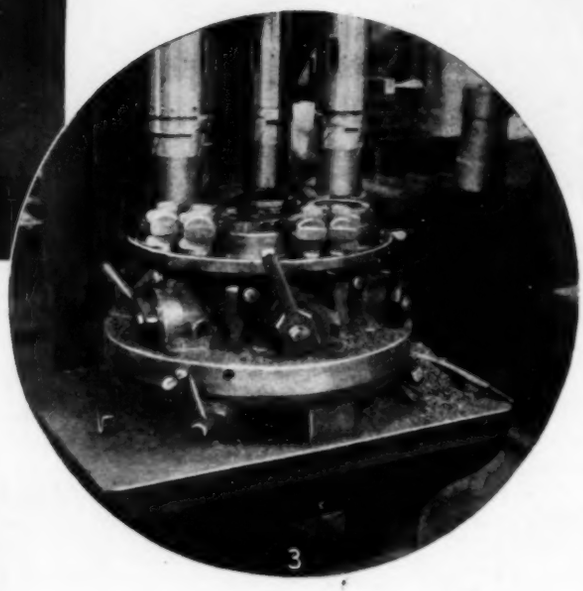


Fig. 3—Hollow milling and facing the boss for the inlet connection. The machine has a four-spindle head and a three-station indexing table. The cutter heads have inserted blades of Stellite

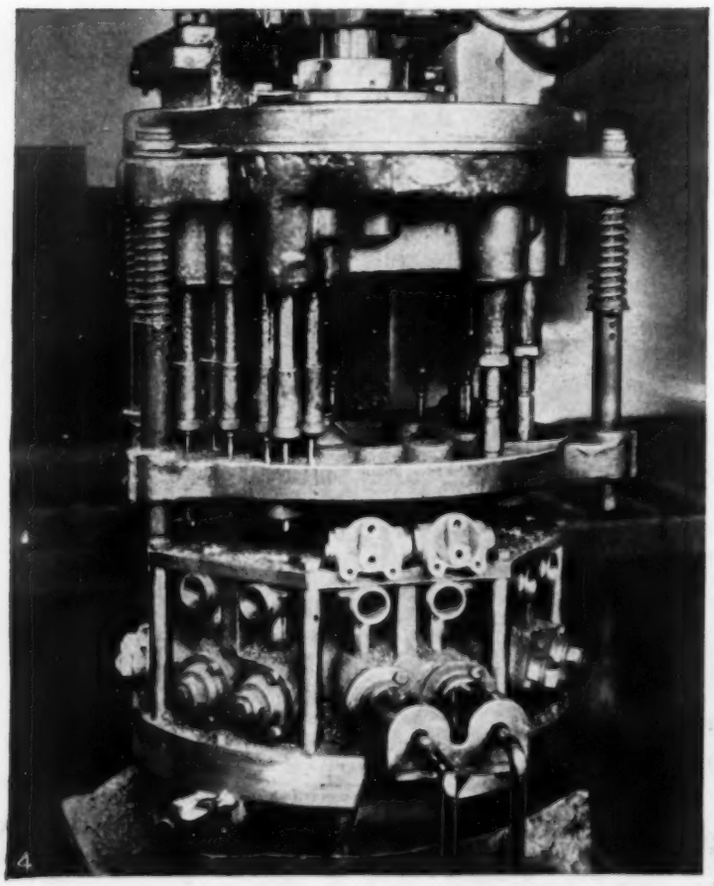


Fig. 4 — Drilling holes in a machine equipped with a six-teen-spindle head. The work is located by the bosses that were machined previously

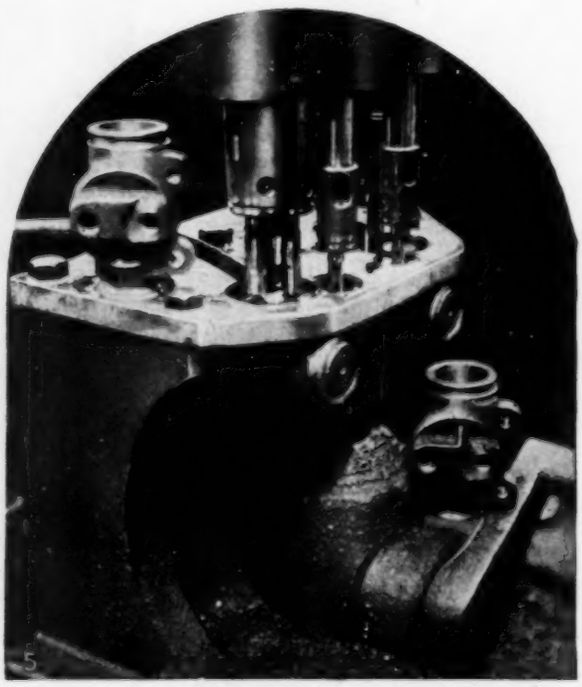


Fig. 5—Tapping holes in a pneumatic tapping machine having an eight-spindle head. The fixture holds two cylinders, both of which are tapped at once. The cylinders are located by their bores and the inlet bosses

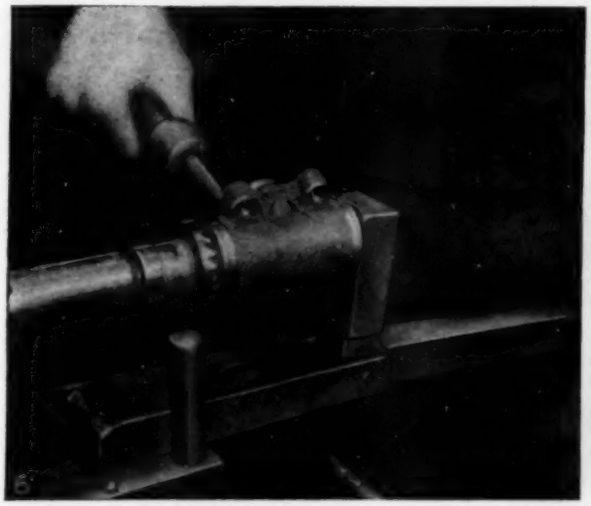


Fig. 6—Chamfering the bores at the ends of the brake cylinders. This operation must be carefully done, leaving the chamfer concentric with the bore. Accuracy is necessary because the chamfered surfaces are for location points in the grinding operation. The tool bar is piloted in the bore.

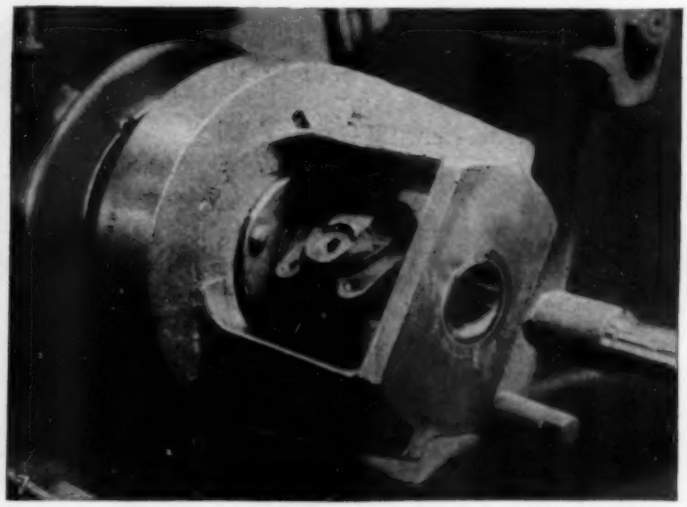


Fig. 7—Grinding the bore of a brake cylinder. The cylinder is located in the fixture by the chamfered surfaces at each end and is held by spring pressure. After being ground, the cylinder is lapped for smoothness. In grinding, the production is 60 per hour

holes and porous spots, otherwise leakage would be apt to take place. Also, that the joints of all connections in the system must be tight.

The pump and brake cylinders are made of close-grained gray iron. In testing them for leakage, alcohol is used because it has the least viscosity of any of the ingredients of which the liquid is composed. The test pressure is 1,200 lb. per sq.in. Prior to being machined the cylinders are annealed, both to soften any hard spots that may be in the castings and to equalize the strains.

The first operation on the brake cylinders, as shown in Fig. 1, is core drilling and reaming the bores, leaving an allowance of from 0.008 to 0.010 in. for grinding. The machine in which the work is done is a drill press equipped with a six-spindle head and hydraulic feed, the feed being automatically controlled so that the return of the tools to the starting position is much faster than the feed during the cut. The pressure in the hydraulic system is registered on a gage conveniently placed in line with the operator's vision. The sliding head of the machine carries a plate in which are the guide bushings for the drills. The reamers float, and no bushings are used for them. The cylinders are held in fixtures of the quick-clamping type mounted on a three-station indexing table, one station being used for loading and unloadiing while the cylinders held in the others are being operated upon. The cylinders are located in the fixtures by bell-mouthed bushings, and are held by compensating clamps. Loading and unloading is very rapid and the production is more than 300 per hour.

Following this operation, the ends of the cylinders are faced, grooved and rough turned, as shown in Fig. 2. The grooving is done to hold in place rubber protectors that are fitted over the ends to exclude all foreign matter likely to cause wear and, consequently, leakage. Both operations are performed in a lathe equipped with two toolblocks. A circular form-tool for the grooving operation is held in the front toolblock, while the one in the rear holds the tools for facing and rough turning. The work is held on a stub mandrel and Stellite tools are used. As the lengths of the cuts are short, the cutting time being not over 5 seconds, hand feed is used. The machine is so arranged that the spindle is started and stopped by the operation of the carriage. A lever pivoted to the bed of the machine is attached by its upper end to the clutch lever and the first lever is connected to the carriage by a link, so that the clutch is engaged or disengaged by movement of the carriage in one or the other direction.

Upon the completion of the foregoing operations, the boss for the inlet connection is hollow milled and its end is faced, as shown in Fig. 3. The work is done in a drill press equipped with a four-spindle head, and in which the feed is hydraulically operated. The tools in two of the spindles are for roughing, while those in the other two are for finishing. The work-holding fixtures are mounted on a three-station indexing table and two cylinders are finished at each indexing. The cylinders are located in the fixtures by the bores and are held by a quick-clamping device in which the clamps are equal-

Fig. 8—Fixture and gages for inspecting the brake cylinders. All threaded holes are checked for size and for the pitches of the threads, and all holes are checked for spacing and for center distance in relation to the cylinder bore

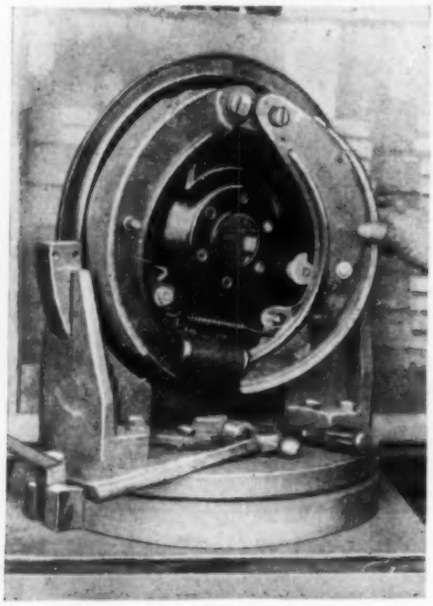


Fig. 9—Brake cylinder in place on the brake-shoe support. The opposed pistons act on the ends of the brake shoes

ized so that they hold the work firmly, regardless of slight variations in its size or shape. The feed is Oilgear controlled and has a slight dwell at the end of the cut, allowing the tools to make a fine finish. The tools carry inserted blades of Stellite and are guided by bushings in a bushing plate of the conventional design. The production is at the rate of 200 per hour. In the next operation, all the holes are drilled, spot faced, and the seats where the cylinders are attached to the brake-shoe supports are finished. The work is done in a drill press equipped with a head carrying sixteen spindles and a bushing plate, the fixtures being mounted on a seven-station indexing table, as shown in Fig. 4. The cylinders are located by the same bosses as were finished by hollow milling in a previous operation. The production is 140 per hour. After all the holes have been drilled they are tapped in a pneumatic tapping machine having an eight-spindle head, as shown in Fig. 5. The fixture holds two cylinders by a cam-operated clamp. They are located by the bores and by the bosses for the inlet connections. The holes in two cylinders are tapped at the same time. The production is 340 per hour.

After a thorough washing to remove the accumulation of chips and dirt, both ends of the cylinder bores are chamfered, the operation being illustrated in Fig. 6. This operation must be carefully done and the chamfering must be concentric with the bores. The necessity for accuracy is because the location of the cylinders for grinding the bores is from the chamfers. The work is done in a horizontal tapping machine having a special spindle carrying a piloted cutter.

The bores are ground on an internal grinding machine, the fixture and grinding wheel being shown in Fig. 7. The work is located by the previously-chamfered ends of the bores and is held in place by spring pressure. After the grinding the bores are lapped. The work is done in a horizontal machine of the same type as the one used for chamfering the bores, and the lap is covered with abrasive paper held on by rubber bands.

The cylinders are again washed and are then inspected in the fixture and by the gages to be seen in Fig. 8. All threaded holes are checked for size and pitch of threads, the bores are gaged and all holes are checked for spacing and for center distances in relation to the bores. This inspection, being the last one before the parts are assembled, is particularly thorough. Because of the fact that the minimum rate at which traffic may move in congested districts is being increased in many cities and states, it is necessary that the braking power of a car be sufficient to control it under the new conditions and the driver must have confidence that it will do so throughout the life of the car. It is not contemplated that the brakes will require any repairs that will necessitate the disassembly of the cylinders and pistons during the life of the car. It is, of course, expected that the brake shoes will be adjusted from time to time and it is possible that one or more of the flexible connections may need replacement, but the hydraulic assembly itself may be considered as a permanently sealed unit.

After inspection, the cylinders, pinions, springs and rubber protectors are assembled. They are then ready for assembly in the brake rigging as in Fig. 9. The assembling fixture is mounted upon a double track built of angle iron, and is moved by the conveyor chain. In Fig. 10 can be seen the assembly line with the assembling fixtures, or clamps, placed on a conveyor. The brake assemblies are taken from the conveyor and sent to the storeroom or chassis assembly department.

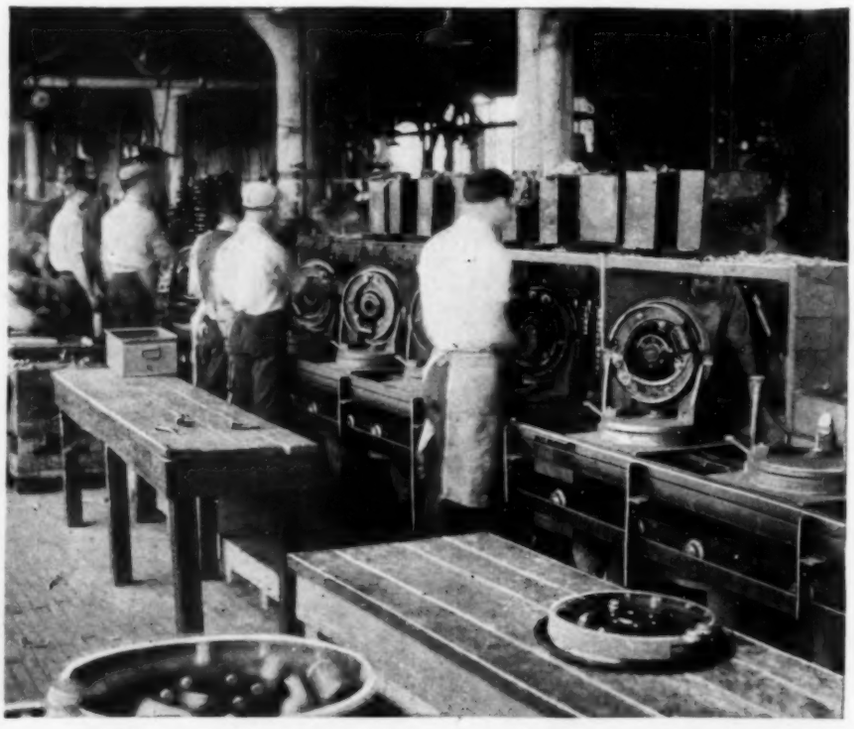


Fig. 10—The brake-assembly line. The assembling fixtures, or clamps, are placed on a conveyor. As the parts are assembled, they are carried as sub-assemblies to either the storeroom or to the chassis assembly

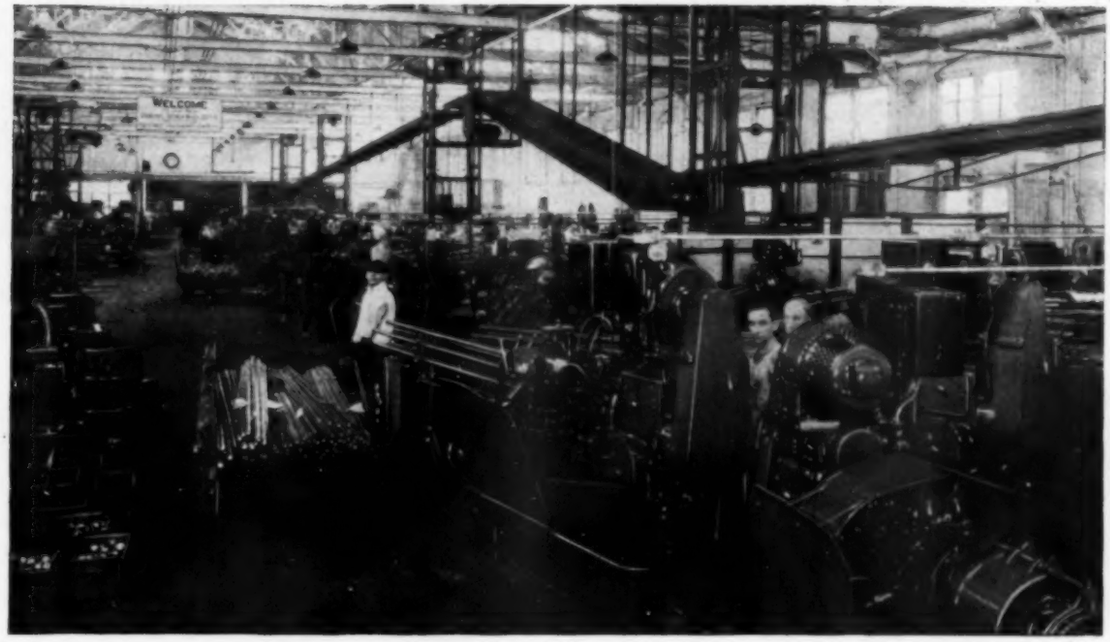


Fig. 1—A side of a screw-machine department where handling is done progressively and mechanically

Mechanical Handling of Screw-Machine Parts

By GEORGE S. BRADY
Associate Editor, American Machinist

LARGE scale production of screw machine parts has developed economic handling methods that are also readily applicable to smaller installations. At the Schenectady plant of the General Electric Company a total of 800,000 to 1,000,000 lb. of raw materials are worked in the screw machine department monthly. An average of about 750 new jobs are handled weekly in this department in addition to about 200 standard items that are manufactured continuously, mostly radio and refrigerator parts. These standard jobs run from 2,000 up to 1,000,000 pieces per week, while the special jobs come in lots of from one piece up to several hundred thousand.

All of the automatics and heavy turret machines are located in one large building, an interior view of which can be seen in Fig. 1. The automatics are set up in the form of a horseshoe, the open end of the shoe facing into the center aisle, and all stock feeds of the machines are from the center. The number of machines forming each horseshoe depends on the type and size, but each group usually numbers 15 or 16. From 4 to 6 operators can easily take care of a group, since all adjustments and inspections can be made readily from the outside of the horseshoe without going between machines.

The raw bar stock is brought in at one end of the building so that it can be trucked directly down the center aisle to the group of machines where needed. The bars are loaded on trailers, which are pulled and distributed by a gasoline tractor. In Fig. 2 is shown a view of the inside of one of the horseshoe groups. A reserve of bar stock can be kept in the usual manner in racks on each machine, and fed into the machine when required from the center without interference in the aisle.

A roller conveyor passes completely around the machine room, and has an elevator station in the center of each horseshoe. The chips and parts are put into metal tote boxes and shoved to the center of the horseshoe on hand trucks such as illustrated in Fig. 3. This work is done by men under the direction of the head porter. These workmen also operate the elevators, sending the work and chips along the conveyor, the boxes being pushed by boosters on the conveyors. In the center of each machine group there is ample room for the storage of any surplus parts in boxes, where for any reason it is necessary to hold up parts at the machines.

The operation of the conveyor about the machine room is continuous in one direction, all boxes of work

and chips arriving regularly at the station shown in Fig. 4, which is located in a side wing of the building. The oil separators are under this section of the conveyor, and are arranged to receive the chips and work directly as they are dumped from the boxes on tilting sections of the conveyor. No handling of the boxes is required as they are held in place and tilted automatically by motor. The empty boxes then continue along the conveyor and return to the machine room where they are removed at the elevators by the porters as required.

An overhead monorail crane is provided to remove the buckets of work and chips from the extractors after the oil has been extracted, and to carry them around to the chip separators located just behind the operators of the extractors. The 500-lb. hoist operating on this conveyor to carry the bucket can be seen in Fig. 4 and in Fig. 5. Care is taken to keep apart the non-ferrous metals from the steel chips. There is no effort made, however, to separate the various grades of steel chips unless a lot of distinctive special steel is sent through. In all cases a copy of the work ticket accompanies the box, so that the grade of metal can be distinguished. In Fig. 5 can be seen the type of chip separator employed. There is no manual handling of the steel chips, and from separators they are blown into a bin at the back of the machines from where they are pushed through a chute in the floor to a chip crusher. From the crusher they pass through a screw conveyor which takes them out of the building to a bucket conveyor. The bucket conveyor is at the side of the building as shown in Fig. 7, and the chips are lifted and sent down a chute into cars on the siding.

About 25 different metals and alloys are handled regularly in the screw machine department. Besides screw steel and brasses, which constitute the bulk of the product, these metals include aluminum, copper, Ascoloy, Nitralloy, and various alloy steels. Silver and platinum are also consumed in making some parts. The chips from the non-ferrous metals and special alloys do not follow the regular procedure and go through the crusher, but are taken from the separator and packed into steel barrels or boxes for shipment. The total scrap handled and shipped from the department is about 400,000 lb. per month.

In one corner of the room at the end of the row of centrifugal oil separators is installed a complete oil-clarifying and sterilizing equipment in which the oil from the separators goes through a DeLaval centrifugal multiple clarifier to a sterilizer. Practically all of the oil from the chips is thus reclaimed and used over again in the screw machines.

After the chips are removed, the work is handled in wire-mesh tote boxes, or trays. These boxes are ele-

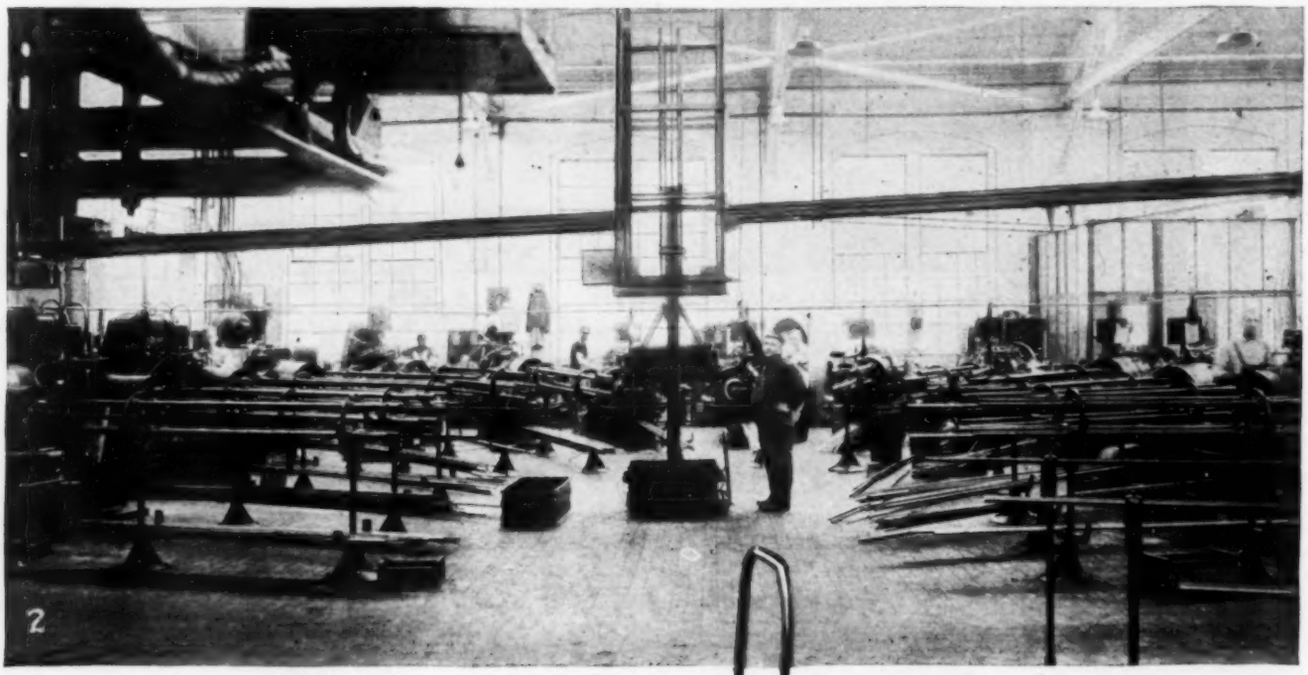


Fig. 2—Automatic screw machines are set up in the form of a horseshoe for convenience in feeding stock and attending the machines. Fig. 3—Type of truck used for pushing back the scrap boxes from the machines to the elevator in the center

vated to the washing machine by elevator, as can be seen in Fig. 6. The operator is also shown pushing one of the boxes into the washing machine, which in this case is the Blakesley type. The tote boxes are brought to this machine by hand, but when the shop installation is finally completed they will be carried by conveyor from the chip separators directly to the table of the machine. It will be noted that the washing machine illustrated in Fig. 6 is double, having a pusher belt for the boxes in the bottom and a screw conveyor at the top. The large lots of small parts, such as screws, go through the screw type of conveyor. In either case the parts are washed and then dried automatically in the machine.

From the washer the boxes pass out to a roller conveyor at the other end, or from the conveyor screw the work goes down a chute to tote box containers. The discharge end of the washer is shown in Fig. 8, with the roller conveyor bringing the work down to the weighers and checkers. At this point a check is made of all parts in process, and the work is then taken in boxes or trays to the inspectors' benches. All parts are given 100 per cent inspection. The empty trays from the inspection benches, which are alongside of the conveyor from the washer, are placed on a gravity roller conveyor at the side of the washing machine and are returned to the operator at the front of the washer. This gravity con-

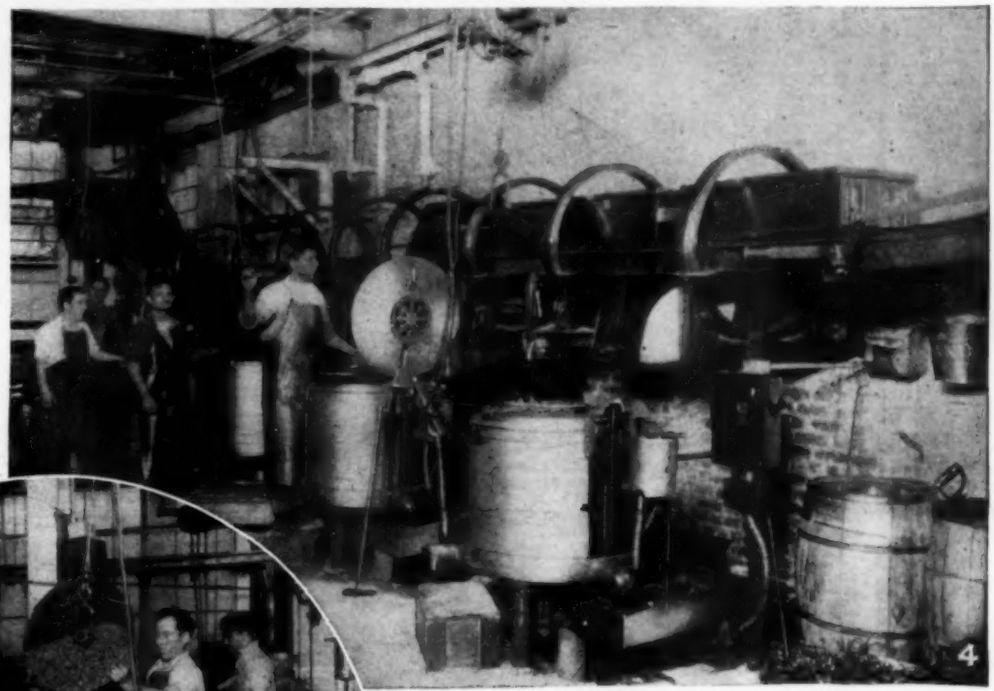


Fig. 4—Dumping work and chips automatically into the oil extractors from the conveyor. An overhead monorail crane takes the buckets from the extractors and brings them to the chip separators, Fig. 5, in the rear

Fig. 6—Front end of the washing machine. The work in boxes is fed onto the pusher belt in the lower part of the machine, and the loose work goes through a screw conveyor at the top

Fig. 8—Discharge end of the washing machine with gravity conveyor for bringing the boxes of work to the weighers

veyor can be seen at the right in Fig. 6. The inspected work is packed in boxes and delivered to the various assembling departments in industrial trucks, which enter the inspection department from the main aisle.

Parts which require slotting, milling, or special operations on hand screw machines or other machines are sent to the second floor of the side bay above the inspection department, where the additional operations are done. This room is equipped with automatic hopper-fed slotters, and automatic machines are employed wherever possible to eliminate rehandling of work. Small heading machines and thread rollers are also located in this room, but the heavy headers are on the main floor to prevent vibration.

Indifference to the Apprentice System—*Discussion*

By A. W. Forbes
President, Forbes & Myers

IN THE *American Machinist*, p. 931, Vol. 70, Charles E. Dawson lays the blame for public indifference to apprenticeship on the fact that some companies have not treated the apprentices fairly. Undoubtedly this has been a factor, but among private schools he will find the situation even worse. We have all seen advertisements of courses that show clearly that they cannot be true, and that show the schools are merely intended to get the money. But the public does not condemn all schools for that reason. It makes no effort, however, to protect boys from bad apprenticeship as it does from bad schools. It merely ignores apprenticeship.

One of the clear reasons for the attitude is advertising. The advertisements of private business schools appear regularly in all papers. Another form is through news items of graduates. A graduate of a school becomes governor of a state, and the local papers consider it first page news. He is represented as a product of their school. If he is the graduate of an apprentice program he appears as "a self-made man."

Among other factors that prevent an interest in apprenticeship, I would give first rank to the social situation. Schools send out catalogs giving lists of their instructors with their degrees and accomplishments. These instructors are received in the best social circles of the local communities. What could more appeal to parents than that their boy should associate with such men? If by any chance these parents should happen to consider apprenticeship, what associations can give equal appeal? They find no indication that the president or higher executive officers will ever see or hear of the apprentices. There may be an apprentice supervisor, but who is he? No one they ever heard of socially. As for the instructors, they are "just shop men."

These are valid reasons why parents should prefer schools to apprenticeship. We cannot find fault with parents for wanting the sons to surpass them socially as well as intellectually, and all our business companies are sure of the effect of long-continued advertising. If apprenticeship is to return to its proper place it must meet these objections. It must do more advertising, both individually and collectively. Large companies should see that contacts are made between the leading men in the company and the apprentices, and they should let the public know that these leading men are dealing with the apprentices. Equally important should be the effort to raise the standards of apprenticeship. With the modern development of trade schools there is no occasion for apprenticeship merely to supply a sufficient quantity of men. These schools can handle the mass, as they wish to do. Apprenticeship should give a superior training to the few rather than ordinary training to the many. But the few cannot be gotten without the necessary advertising.

Reducing the Costs of Distribution

By Robert F. Elder
Specialist in Market Research, Brown Company

An abstract of the 1929 Alvin T. Simonds economic award paper. The prize of $1,000 is given annually by Alvin T. Simonds, president, Simonds Saw & Steel Company, for the best paper on a selected economic topic. The award was made by a committee of the American Management Association

IMPROVEMENT of the mechanics of production; the transition from handicraft to shop, from shop to modern factory, has been a succession of steps toward specialization and centralization of industry. In the beginning we were a people of few wants, rather indifferently supplied. As those few wants were better satisfied, there was time to discover new wants, and the clamor for "more production" continued. In response, better machinery was invented; labor grew more efficient; research discovered new methods; better plans of organization were evolved.

Distribution lagged behind in the rapid advance of productive efficiency. As a general rule whatever was made could be sold profitably. Distribution, therefore, often proceeded by devious channels established by chance and perhaps long since rendered obsolete. It was inevitable that eventually the backwash from a clogged distribution system should slow down the wheels of production.

The goal of every manufacturer is to operate his factory at somewhere near its capacity. Most manufacturing industries carry a heavy load of overhead, and capacity production on a profitable basis, is the surest road to dividends. But no business can long produce more than it can sell. The easiest way to increase sales volume, as every business man knows, is to cut prices. To decrease prices and still operate profitably means that lower costs are necessary.

In general, the greater the volume of production, the less is the cost per unit; but, also, the more difficult is the problem of distribution. In many cases a high distribution cost acts as a bar to maximum volume. It minimizes the effect of production economies. If half of the consumer's dollar goes for production and half for distribution, a ten per cent reduction in costs of production means only a five per cent reduction to the consumer. A price-cut due to reduced distribution costs is just as potent in increase of sales volume as a cut due to production economies; and in the present state of industry it is much easier to effect.

"Cost of distribution" is a term which is often loosely employed. Obviously, every item of cost between the completed product on the floor of the factory shipping room and the consumer's hands is a part of the total. There are the costs of physical distribution; wrapping, packaging, freight charges, warehousing, and trucking. Then there is the separate class of selling costs; salesmen's salaries and commissions, traveling expenses, sales executives' salaries, office expense, and advertising expense. There is in addition a third class of distribution costs which is of a functional nature, and incidental to certain systems of distribution. This includes such items as jobbers' and brokers' commissions and profits.

A great obstacle to the remedying of high distribution costs is the very indefiniteness of the problem. It is impossible to weigh and measure the factors involved with the precision afforded by production problems.

In many instances the high cost of distribution is chargeable to an insatiable demand for volume of business: This leads in many cases to intensive "high-pressure" methods, with crews of canvassers, unwarranted advertising appropriations and the other trappings of "business at any price." The craze for volume may be due in part to the pressure of accumulated savings seeking investment, which makes it easy to find capital for plant extensions, and for new ventures. Even a small increase in real wages brings about a large increase in the margin between the subsistence level and income. Actual living expenses, such as rent, food, and clothing show only a moderate increase. Expenditures for luxuries and semi-luxuries, like automobiles, electric refrigerators, radio sets, increase very considerably. Savings also show a large increase quite disproportionate to the increase in real wages. Accumulated savings directly, or indirectly, seek investment in productive enterprise. Thus the practice of saving exerts on the one hand a pressure toward increased production, while on the other hand it diminishes the funds available for purchase of consumer's goods.

The road to lower costs, in distribution as in production, is a thorough-going analysis of all the factors contributing to the problem. The fundamental requisite is a real comprehension of economic principles, not as textbook rules, but as forces which operate as inexorably as chemical laws. It is surprising to see how little some business men concern themselves with economic laws. Perhaps it is because they are so seldom demonstrated in a tangible, clear-cut manner.

Efficient distribution is a measurement of intangibles. "Know your market" is the first and greatest commandment. Many an industry has caused itself severe pains by attempting to crowd ten millions worth of product into a five-million-dollar market. Call it a "saturation point" or what you will, there is a limit to the amount

of any commodity which can be sold profitably at a given time. As that point is approached, the economic law of "diminishing returns" begins to operate. Increased volume is obtained only at a constantly increasing cost per unit. Your salesman is getting down closer and closer to the marginal consumer; prospects are scarcer and harder to sell; and costs of distribution creep upward.

Often statistics are available which make it possible to measure very closely the total market for a commodity. In other cases it is necessary to resort to estimates. That is no reason for abandoning the analysis; a guess is better than blank ignorance. Once the total market for the commodity is known, or estimated, the individual firm's place in the market is determined. Here, at least, is something concrete and measurable.

Evaluation of Competition

Then comes evaluation of competition. What competitors are expanding, and how will the market absorb the added production? What outside forces are at work to increase or decrease the total consumption of the commodity? Having determined the size of the market, and the slice which competitors will probably get, it is possible to set a reasonable quota for the individual company. This can be checked with records of past sales.

Then comes the question of distribution cost. This requires thorough analysis. In what lines are we in the zone of "diminishing returns?" Perhaps there are sizes or styles of product which are unduly expensive to sell. Cut them out! Perhaps sales made within a radius of a hundred miles cost much less per unit than those made at greater distances. Very well, let us increase our efforts in the hundred-mile zone and try to increase the percentage of our sales made there.

An efficient department devoted to the study of distribution questions, whether consisting of part of the time of one of the executives or the exclusive services of experts, can be of the greatest aid in holding down distribution costs. Only by thorough-going analysis of both product and market can an efficient distribution policy be built.

Business success today lies in producing what people will buy; not in making what you want to make and then bending every effort to sell it. This is a truth which has not percolated into the minds of many executives. Others accept it in theory and ignore it in practice. Failure to recognize this fact keeps the distribution costs of many products sky-high. Fooling the public is an expensive business at best. It is far simpler and easier to learn what people want and give it to them, than to guess wrong and have to cram the mistake down the public throat. Here is one opportunity for a market analysis function. The consumer's preferences can be studied and the product so fitted as to reduce the selling pressure required, and hence decrease the cost per unit.

The sales records of past years, if at all properly kept, offer a rich field for exhuming constructive ideas. They should show what channels of distribution have been most efficient; what trade areas have been covered at reasonable cost, and where competition, or distance, has made distribution expensive. From them it should be possible to determine what forms of advertising have been worth while, and what have proved mere wasters of profit. In fact, here is the possibility of a real laboratory to study the economic aspects of a business, just as a chemical research laboratory studies its technical problems.

There are two ways to cut distribution costs. One is to spend less money to sell the same volume of goods. The other is to sell more goods without increasing the total amount spent for distribution.

Competition is becoming keener day by day. A tremendous and constantly increasing volume of savings is clamoring for productive investment. Most of the sound stocks have been forced upward in price, so that common stock yields are down to four and five per cent. New outlets must be provided for the funds seeking investment; and it will not be hard to finance strong competition in fields where wasteful methods persist. Inefficient production methods have gone by the board so far as successful companies are concerned. Wasteful methods of distribution offer just as great an opportunity to competition.

Efficient distribution is a many-sided problem. The product must be such that it will be readily accepted by the consumer without the need for expensive "education," —too often a polite term for bludgeoning a man into buying something that he does not want and will never use. It must be satisfactory in use, so that repeat business will be held. Production must not be beyond the capacity of the market to consume at a price profitable to the producer. If the market is glutted, there is always a panic of high-pressure selling which never pays its own way. The sales efforts put forth should be of the nature and extent to produce the maximum results per dollar spent. To insure this, plans should be drawn up in advance, taking into account economic, geographic, and climatic conditions. Records should be kept, in which results are analyzed for guidance in future years. An open mind for new methods and new channels of distribution, tempered with a plentiful supply of that oldest and rarest ingredient of business, sound common sense, will complete the equipment of an executive who can sleep nights.

Tom Johnson Has a Plan to Reduce Unemployment—*Discussion*

By H. James
Birmingham, England

IN COUNTRIES where national or local unemployment relief schemes are in force, Tom Johnson's plan of training schools is also in operation. In the case of the men who are referred to in the article on page 600, Vol. 70, of the *American Machinist,* payment of unemployment benefit is made contingent on attendance at a training school, and additional allowances for tools and equipment are sometimes made. The training is intensive, and the course lasts at the most a few months. In the building and similar trades it is followed by a period of modified apprenticeship, but in semi-skilled occupations the employer has to arrange for any further training that is necessary.

In Europe the cost of training schools is borne by the community and is justified by the fact that the public burden of unemployment benefit is thereby reduced, but in America where this argument cannot apply, at least a part of the cost of any such scheme as Johnson's would have to be borne directly by the employers.

It would also be necessary to allow the men some compensation for productive work done; or loans made to them, which would be repaid from their earnings when employed.

IDEAS FROM PRACTICAL MEN

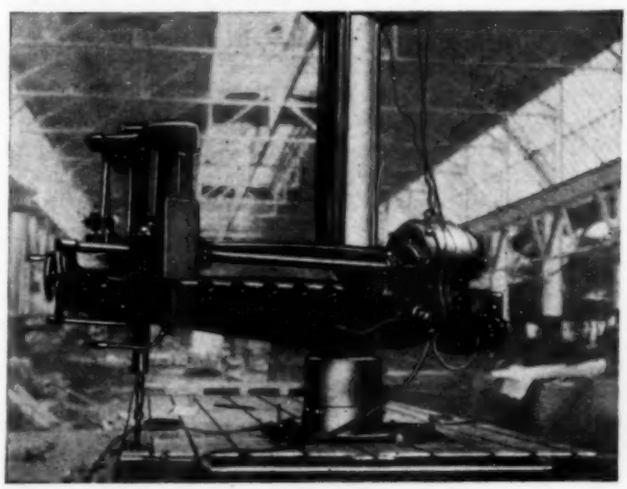
The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Taking the Machine to the Work

BY O. C. WILLEY
Superintendent Cincinnati Planer Company

Recently we had to drill, ream and countersink 1,012 holes in a 9 x 27-ft. planer table weighing more than 50,000 lb. 500 of the holes were for the location of stops, while the other 512 were for letting the dirt and chips out of the T-slots.

A 6-ft. radial drill, without the base, was mounted on the table, as shown in the illustration. It was held in place by clamps, the bolts of which were located in the center T-slot. By moving the drill three times, all the holes were finished. If the table had been blocked up in front of a radial drill to do the work, it would have been necessary to have moved it ten times, leveling it after each move. Besides, the work being done on several machines near the radial drill would have been interfered with. The job was completed in a surprisingly short time.

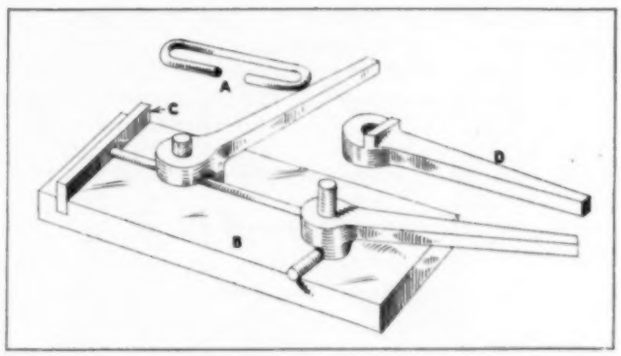


A radial drill taken to the job

A Wire-Bending Fixture

BY CHARLES H. WILLEY
Assistant Plant Superintendent, Hoyt Electrical Works

In the manufacture of ammeters of a certain type, coils or loops, of wire as shown at *A*, are required. Such coils can be bent quickly and cheaply by a hand-operated fixture when the quantity is not sufficient to warrant the purchase of an automatic machine. The coils can be bent in the fixture shown at *B*. It consists of a base having a stop at *C* and carrying two vertical pins, also two levers of the shape shown at *D*. Its operation is simple. The wire, cut into the proper lengths, is placed in position against the stop and the levers are put on the vertical pins with the wire between their lugs and the pins. Alternately turning the levers in opposite directions, as shown, does the trick.



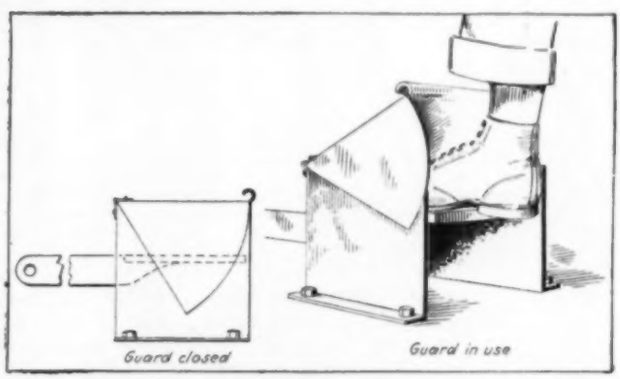
Fixture for bending ammeter coils

Safety Guard for Punch-Press Treadles

BY P. G. DENNISON
Supt. Wire Production Division, A. O. Smith Corporation

The illustration shows a safety guard for the treadles of punch presses that is comfortable for the operator. While the one-piece box-like guard in general use eliminates the danger of the press being tripped by objects falling on the treadle, it has the disadvantage of being uncomfortable for the operator. He can enter a part of his foot only, which becomes very tiresome before the day's work is done. Also, he strikes the upper part of his foot against the top of the guard in the endeavor to reach as far as is possible into the guard.

With the hinged-cover type of guard shown in the illustration, the operator can use the whole or any part



Guard for the treadle of a punch press

of his foot that he desires, so as to make it comfortable for him to operate the press. This feature is very desirable in cases where the operator must depress the treadle for each stroke of the press.

The guard should be made of $\frac{1}{8}$- or $\frac{3}{16}$-in. sheet steel and should be firmly fastened to the floor, so as to withstand any such abuse as being kicked, bumped by trucks, etc. The cover may be made of $\frac{3}{32}$-in. stock. The guard should be so located in relation to the treadle as to extend at least $1\frac{1}{2}$ in. beyond its front edge. In this location, the press cannot be accidentally tripped by objects falling, or truck handles being dropped, upon the treadle.

The side walls of the hinged cover not only guard the sides, but also act as counterweights to close the cover when the operator removes his foot. Guards of the type illustrated are compulsory as safety measures in our plant.

Boring a Curved Hole

By B. H. E. MacLean
Instructor, Owen Sound Vocational School

So far as I am aware, the operation of boring a curved hole is rare. I have never seen it published during several years reading of technical magazines, nor did I run across it or hear it mentioned during my practical experience.

The method shown in the illustration was worked

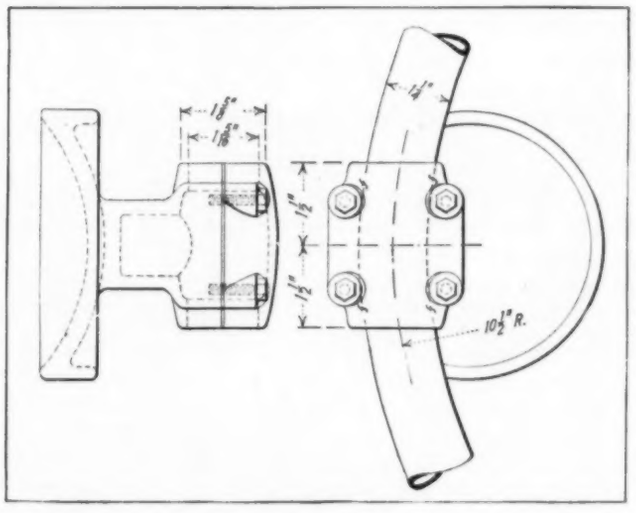


Fig. 1—An aluminum casting that required a smoothly finished bored hole with a radius of 10½ inches

out as a practical operation by Ernest Bailey, a pupil at the Owen Sound Vocational School at Owen Sound, Ontario. He also laid out the set-up.

The railing behind which the conductor stands, is curved, its radius being $10\frac{1}{2}$ in. The casting is an aluminum change tray, as shown in Fig. 1, and a better fit was desired than could be obtained with a casting, and the operator undertook to solve it.

The operation was done on a horizontal milling machine, as shown in Fig. 2, using a circular table. The work *A* was clamped along the center line *B*, and then backed away to *C* as shown. A boring bar was set at the center of the work, when it is in *B* position, a trial cut is taken and then a finishing cut. The diameter of the boring tool must be such that it will not strike the

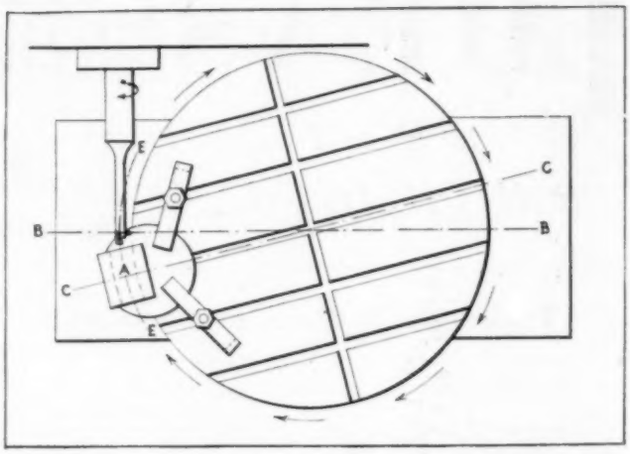


Fig. 2—Set-up on a horizontal milling machine for boring a curved hole

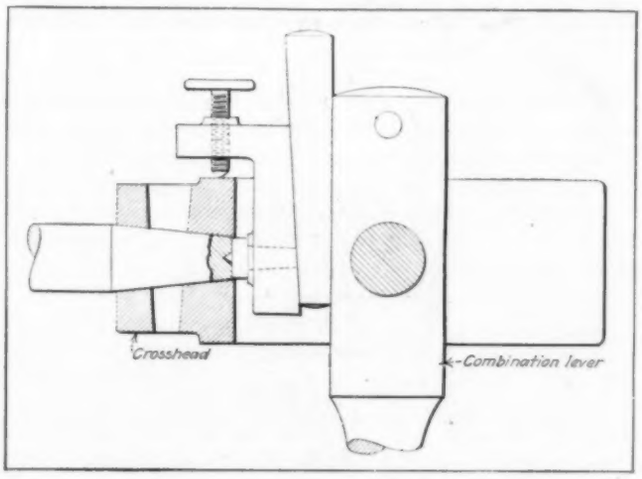
outside of the hole in the casting before the operation is finished.

Extractor for Stems of Piston Valves

By H. H. Henson

Whenever locomotive piston rods are given a hammer test for cracks, the valve stems are thoroughly inspected, necessitating removal from their crossheads. The ends of the valve stems are tapered and fit in taper holes in the crossheads. Because of the tight fit and the fact that the crossheads are so designed as to make the stem ends inaccessible to a hammer, some sort of an extractor as is shown is required to remove them.

It consists of two tapered members, a wedge and a gib. The gib has an L-shaped extension at the top, in which is fitted a screw for adjusting it for height. Near the bottom a hole is drilled to receive the tang of a pushing pad. Pushing pads having heads of different lengths, or heights, are carried in stock to suit the clearances between the inner faces of the cross-



Locomotive valve-stem extractor

heads and the combination levers of the several types and makes of locomotives. Each pushing pad has a teat to guide it by entering the center hole in the end of the valve stem. With the wedge and the gib in place, a few blows on the wedge will remove the valve stem.

Bevel Gear Charts

Axial Thrust-Load Values for Transmitted Load of One Pound

Number of Teeth		38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
10	A	.147	.151	.154	.159	.163	.167	.172	.177	.182	.188	.194	.200	.207	.214	.222	.230	.238	.248	.258	.269	.280
	B	.289	.288	.288	.287	.286	.286	.285	.284	.283	.282	.281	.280	.279	.277	.276	.274	.272	.270	.267	.264	.261
	C	.250	.250	.249	.249	.248	.248	.247	.246	.245	.244	.244	.243	.242	.240	.239	.237	.235	.233	.231	.229	.226
	E	.263	.270	.278	.286	.294	.303	.313	.323	.333	.345	.357	.370	.385	.400	.417	.435	.455	.476	.500	.526	.556
11	A	.160	.164	.169	.174	.178	.182	.187	.193	.199	.205	.211	.218	.225	.232	.240	.249	.258	.268	.278	.289	.300
	B	.287	.286	.285	.285	.284	.283	.282	.281	.280	.279	.278	.276	.275	.273	.271	.269	.267	.264	.261	.258	.255
	C	.248	.248	.247	.247	.246	.245	.244	.243	.243	.242	.241	.239	.238	.236	.235	.233	.231	.229	.226	.223	.220
	E	.290	.297	.306	.314	.324	.333	.344	.355	.367	.379	.393	.407	.423	.440	.458	.478	.500	.524	.550	.579	.611
12	A	.174	.178	.182	.187	.192	.197	.202	.208	.214	.220	.227	.234	.242	.250	.258	.267	.276	.286	.297	.308	.320
	B	.285	.284	.283	.282	.281	.280	.279	.278	.277	.276	.274	.273	.271	.269	.267	.265	.262	.259	.256	.252	.248
	C	.247	.246	.245	.244	.244	.243	.242	.241	.240	.239	.238	.236	.235	.233	.231	.229	.227	.224	.222	.218	.215
	E	.316	.324	.333	.343	.353	.364	.375	.387	.400	.414	.429	.444	.462	.480	.500	.522	.546	.571	.600	.631	.667
13	A	.188	.192	.196	.201	.206	.212	.217	.223	.229	.236	.243	.250	.258	.266	.275	.284	.293	.304	.314	.326	.338
	B	.282	.282	.281	.280	.279	.278	.277	.275	.274	.272	.271	.269	.267	.265	.262	.260	.257	.254	.250	.246	.242
	C	.244	.244	.243	.243	.242	.241	.239	.238	.237	.236	.235	.233	.231	.229	.227	.225	.223	.220	.217	.213	.209
	E	.342	.351	.361	.371	.382	.394	.406	.419	.433	.448	.464	.482	.500	.520	.542	.565	.590	.619	.650	.684	.722
14	A	.200	.204	.209	.214	.220	.225	.231	.237	.244	.251	.258	.266	.274	.283	.291	.300	.309	.320	.330	.342	.353
	B	.280	.279	.278	.277	.276	.275	.273	.272	.270	.269	.267	.265	.263	.260	.258	.255	.252	.248	.244	.240	.236
	C	.242	.242	.241	.240	.239	.238	.237	.236	.235	.233	.231	.229	.228	.226	.223	.221	.218	.215	.212	.208	.204
	E	.368	.378	.389	.400	.412	.424	.438	.452	.467	.483	.500	.519	.539	.560	.583	.609	.636	.667	.700	.737	.778
15	A	.212	.216	.222	.227	.233	.238	.245	.251	.258	.264	.272	.280	.288	.297	.305	.315	.324	.335	.346	.357	.369
	B	.278	.277	.275	.274	.273	.272	.270	.269	.267	.265	.263	.261	.258	.256	.254	.250	.247	.243	.239	.234	.229
	C	.240	.240	.239	.238	.237	.236	.235	.233	.231	.229	.228	.226	.224	.222	.220	.217	.214	.211	.207	.203	.198
	E	.395	.405	.417	.429	.441	.455	.469	.485	.500	.517	.536	.556	.577	.600	.625	.652	.682	.714	.750	.790	.833
16	A	.224	.229	.234	.239	.245	.252	.258	.264	.271	.278	.286	.293	.302	.310	.320	.329	.340	.350	.360	.372	.383
	B	.275	.274	.273	.271	.270	.259	.267	.265	.263	.261	.259	.257	.254	.251	.248	.245	.241	.237	.233	.228	.223
	C	.238	.237	.236	.235	.234	.233	.231	.229	.228	.226	.224	.222	.220	.218	.215	.212	.209	.206	.202	.198	.193
	E	.421	.432	.445	.457	.470	.485	.500	.516	.533	.552	.572	.593	.615	.640	.667	.696	.727	.762	.800	.842	.889
17	A	.235	.241	.246	.252	.258	.260	.270	.277	.284	.292	.299	.307	.316	.324	.333	.343	.353	.363	.373	.384	.396
	B	.272	.271	.270	.268	.267	.265	.264	.261	.260	.257	.255	.252	.250	.247	.244	.240	.236	.231	.227	.222	.217
	C	.236	.235	.234	.232	.231	.230	.228	.226	.225	.223	.221	.219	.217	.214	.211	.208	.204	.200	.196	.192	.188
	E	.447	.460	.472	.486	.500	.515	.531	.548	.567	.586	.607	.630	.654	.680	.708	.739	.773	.810	.850	.895	.944
18	A	.247	.252	.258	.264	.270	.276	.283	.290	.297	.304	.312	.320	.328	.337	.346	.356	.365	.375	.386	.397	....
	B	.270	.268	.267	.265	.264	.262	.260	.258	.256	.254	.251	.248	.245	.242	.239	.235	.231	.227	.222	.217	....
	C	.234	.233	.231	.230	.229	.227	.225	.223	.222	.218	.217	.215	.212	.210	.207	.204	.200	.196	.192	.187	....
	E	.474	.487	.500	.514	.529	.546	.563	.581	.600	.621	.643	.667	.692	.720	.750	.783	.818	.857	.900	.947	....
19	A	.258	.263	.269	.275	.282	.288	.294	.302	.309	.316	.324	.332	.340	.349	.358	.367	.377	.387	.397	....	....
	B	.267	.265	.254	.262	.261	.259	.257	.254	.252	.250	.247	.244	.241	.238	.234	.230	.226	.221	.216	....	....
	C	.231	.230	.229	.227	.225	.224	.222	.220	.218	.216	.214	.212	.209	.206	.203	.200	.196	.191	.187	....	....
	E	.500	.514	.528	.543	.559	.576	.594	.613	.633	.655	.679	.704	.731	.760	.792	.826	.864	.905	.950	....	....
20	A	.268	.274	.280	.286	.292	.299	.306	.313	.320	.327	.335	.343	.352	.360	.369	.378	.388	.398	....	....	....
	B	.264	.263	.261	.259	.257	.255	.254	.251	.248	.246	.243	.240	.237	.233	.229	.225	.221	.216	....	....	....
	C	.228	.227	.226	.224	.223	.221	.220	.218	.215	.213	.211	.208	.205	.202	.198	.195	.191	.187	....	....	....
	E	.526	.541	.556	.571	.589	.606	.625	.645	.667	.690	.714	.741	.769	.800	.834	.870	.909	.952	....	....	....
21	A	.279	.285	.293	.297	.303	.310	.316	.324	.331	.338	.346	.354	.363	.371	.380	.389	.398	....	....	....	....
	B	.261	.260	.258	.256	.254	.252	.249	.247	.244	.242	.239	.236	.232	.228	.225	.220	.216	....	....	....	....
	C	.226	.225	.223	.222	.220	.218	.216	.214	.212	.210	.207	.204	.201	.198	.195	.191	.187	....	....	....	....
	E	.553	.568	.583	.600	.618	.636	.656	.677	.700	.724	.750	.778	.807	.840	.875	.913	.955	....	....	....	....
22	A	.289	.295	.301	.307	.313	.320	.327	.334	.341	.349	.356	.364	.373	.381	.390	.399					
	B	.258	.257	.255	.253	.251	.248	.246	.243	.241	.238	.235	.231	.228	.224	.220	.216					
	C	.224	.222	.220	.219	.217	.215	.213	.211	.209	.206	.204	.200	.197	.194	.191	.187					
	E	.579	.595	.611	.629	.647	.667	.688	.710	.733	.759	.786	.815	.846	.880	.917	.957					
23	A	.298	.304	.311	.317	.323	.330	.337	.344	.351	.358	.366	.374	.382	.391	.399						
	B	.255	.253	.252	.249	.247	.244	.242	.240	.237	.234	.231	.227	.224	.220	.215						
	C	.221	.220	.218	.216	.214	.212	.210	.208	.206	.203	.200	.197	.194	.191	.186						
	E	.605	.622	.639	.657	.676	.697	.719	.742	.767	.793	.821	.852	.885	.920	.958						
24	A	.308	.314	.320	.326	.333	.339	.346	.353	.360	.368	.375	.383	.391	.400							
	B	.252	.250	.248	.246	.244	.241	.239	.236	.233	.230	.227	.223	.219	.215							
	C	.218	.217	.215	.213	.211	.209	.207	.204	.202	.199	.196	.193	.190	.186							
	E	.632	.649	.667	.686	.706	.727	.750	.774	.800	.828	.857	.889	.923	.960							
25	A	.317	.323	.329	.335	.342	.348	.355	.362	.369	.377	.384	.392	.400								
	B	.249	.247	.245	.243	.240	.238	.235	.232	.229	.226	.223	.219	.215								
	C	.216	.214	.212	.210	.208	.206	.204	.202	.198	.196	.193	.190	.186								
	E	.658	.676	.695	.714	.735	.758	.781	.807	.833	.862	.893	.926	.962								
26	A	.326	.332	.338	.344	.350	.357	.364	.371	.378	.385	.393	.400									
	B	.246	.244	.242	.240	.237	.234	.231	.229	.225	.222	.219	.215									
	C	.213	.212	.210	.208	.205	.203	.200	.198	.195	.192	.189	.186									
	E	.684	.703	.722	.743	.765	.788	.813	.839	.867	.897	.929	.963									
27	A	.334	.340	.346	.352	.359	.365	.372	.379	.386	.393	.401										
	B	.243	.241	.239	.236	.234	.231	.228	.225	.222	.218	.215										
	C	.210	.209	.207	.205	.203	.200	.197	.195	.192	.189	.186										
	E	.711	.730	.750	.771	.794	.818	.844	.871	.900	.931	.964										
28	A	.342	.348	.354	.361	.367	.373	.380	.387	.394	.401											
	B	.240	.238	.236	.233	.230	.228	.225	.221	.218	.215											
	C	.208	.206	.204	.202	.199	.197	.195	.192	.189	.186											
	E	.737	.757	.778	.800	.824	.849	.875	.903	.933	.966											
29	A	.350	.356	.362	.368	.374	.381	.387	.394	.401												
	B	.237	.235	.232	.230	.227	.224	.221	.218	.215												
	C	.205	.204	.201	.199	.196	.194	.191	.189	.186												
	E	.763	.784	.806	.829	.853	.879	.906	.936	.967												
30	A	.357	.363	.369	.375	.382	.388	.394	.401													
	B	.234	.232	.229	.227	.224	.221	.218	.214													
	C	.203	.201	.199	.196	.194	.191	.189	.186													
	E	.790	.811	.833	.857	.882	.909	.938	.968													

A = Spiral thrust; B = Spiral bevel cone thrust; C = Straight bevel cone thrust; D = Spiral bevel axial thrust. When A and B thrust are in the same direction, D = A + B; and when A and B are in opposite directions, D = major — minor value. The values for A, B and C in the chart are for the gear only. To obtain the pinion values, divide A by E; and multiply B and C by E. E = Decimal gear ratio. T = Tooth pressure angle = 14 deg. 30 min.; S = Spiral angle = 30 degrees.

Required the axial thrust load on a gear and pinion set, the pinion diam. being 6 in., the gear diam. 13 in., and the pinion transmitting 25 hp. at 350 r.p.m. Since 6 to 13 is the same ratio as 12 to 26, the values A = 0.242 and B = 0.271, come direct from the intersection of 12 in the vertical column and 26 in the horizontal column. For the gear then, D = 0.271 — 0.242 = 0.029; and for the pinion D = $\frac{A}{E} + BE\frac{0.242}{0.4615} + (0.271 - 0.4615) = 0.650$. From sheet No. 27a, at the intersection of the 350 r.p.m. and 6 in. lines the load per horsepower is 60 lb. Therefore, the load for 25 hp. is 1,500 lb.; and the thrust for the gear is 0.029 x 1,500 = 43.5 lb., and for the pinion is 0.650 x 1,500 = 975 lb.

For 17 deg. 30 min. pressure angle, multiply values B or C by 1.22; and for 20 deg. pressure angle, multiply values B or C by 1.41. For the bevel gears with spiral angle other than 30 deg., the value of A = $\frac{\text{tabular A} \times \tan S}{0.5773}$; and the value of B = $\frac{\text{tabular B} \times 0.866}{\cos S}$.

Contributed by A. Wasbauer, Engineer, The Ingersoll Milling Machine Company

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Tariff Education

PRACTICALLY every man not in politics would be happier if the tariff were taken out of politics. At the same time, he—and the politicians as well—are guilty of an ignorance of the fundamentals of tariff theory and practice that is abysmal.

Four out of five men with whom you try to discuss tariff matters promptly disclaim any interest in the subject. They maintain that it only affects those engaged in importing, or in manufacturing goods that compete with imported products, forgetting entirely that the tariff may have a profound effect on national prosperity, and that national prosperity is sure to affect their private interests.

It was not so long ago that the general public expressed the same indifference to railroad rates—and rebates. But that situation got so bad that public sentiment was aroused to the point of punitive legislation, and the reaction of the remedy was probably worse than the disease. People became educated, to a certain extent, as to the relation of railroad rates to general prosperity.

If the time comes when public education on tariff matters reaches an equally advanced stage we may expect some intelligent action to find a substitute for the present unsatisfactory method of handling the tariff problem by political compromise. That time will be hastened if every progressive business man will undertake to inform himself on tariff questions, and then do what he can to urge that others be equally well informed.

*

Eye Accidents Cost $50,000,000

GOGGLES have been used for eye protection for many years, and we all know that many accidents have been prevented by their use. There is, however, a reluctance on the part of many workmen to use goggles, especially in hot weather. They take chances with one of their most precious possessions, sight, rather than put up with a little discomfort.

A recent statement by the representative of the National Society for Eye Protection gives interesting statistics as to the number of eyes that have been saved by the use of goggles. The survey, covering over two years in 583 large plants, shows that at least 2757 men and women were saved from serious eye injury, or blindness, in both eyes, and 4654 were saved from injury or loss of one eye. These figures are on the assumption that every time a goggle lens is shattered, pierced or spattered with molten metal or corrosive chemical an eye is saved.

In addition to the suffering and loss of enjoyment due to eye injury there is apt to be a lowering of earning capacity, and at times the necessity of learning a new trade. It is stated that the industries of the country are now paying approximately $10,000,000 a year as compensation to workmen who have been totally or partially blinded at work. The indirect loss from the same cause is estimated at four times the above, making a total cost of $50,000,000 that is reflected in the cost of living.

Knowing that goggles do save many eyes it is obvious that management should endeavor to secure willing co-operation in their use, and if necessary, to insist that employees take no unnecessary chances in potentially dangerous places.

*

American Management

IN A recent address before the American Management Association, C. S. Ching commented on the fact that American management is getting considerable prominence abroad. He did not say that American management is better than any other kind of management, but the inference is plain that it must have merit to arouse so much discussion.

That such interest has been aroused is decidedly flattering, but we shoud not assume that because the outstanding examples of good management have atracted attention all American management is equally excellent. Nothing could be farther from the case. Those managers who decide to rest on their laurels because the work of their contemporaries has been applauded are running the risk of an extremely rude awakening.

Not only are they in danger from more progressive competitors in the United States but they may suddenly discover that the alert managers of other countries have emulated the leaders of this country and drawn ahead of the trailers while the latter were asleep.

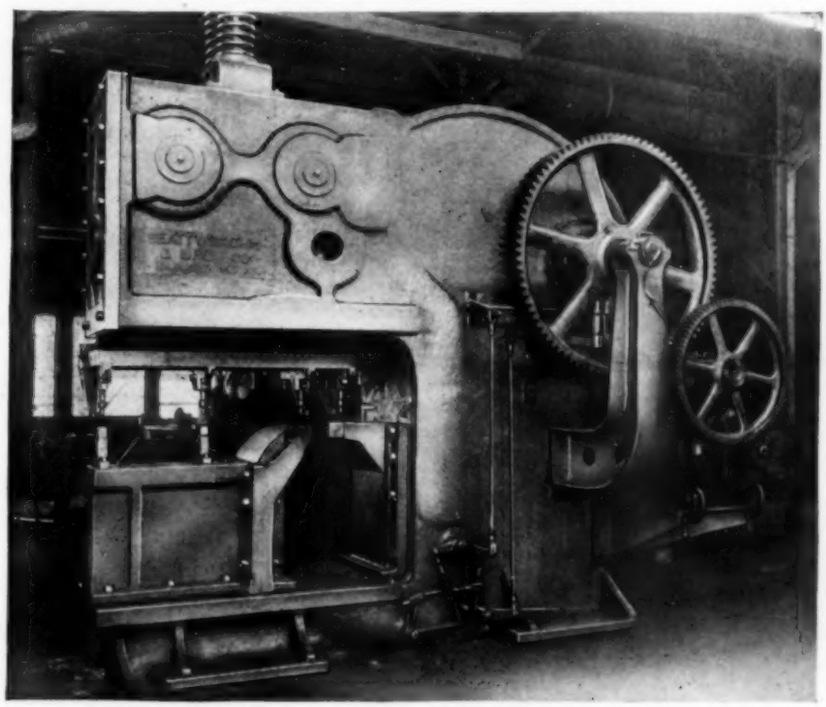
MATERIALS · PARTS · AND · EQUIPMENT

Beatty Heavy-Duty Toggle Punches

A SERIES of heavy-duty toggle punches has been placed on the market by the Beatty Machine & Manufacturing Company, Hammond, Ind., to meet the requirements in structural steel shops caused by the increased sizes of structural steel sections which are now fabricated. The punching of flanges and webs in one handling requires a large die space, or length of head from front to back. These presses have this feature. For added strength and rapidity of action in the head of the punch, the main body extending up in the housing has been lengthened to the same size as the face, or space for tooling. A double set of toggles, spaced at equal distances, is used to operate the head and distribute the pressure equally. These toggles are operated by a connecting rod leading to the main shaft, which is mounted through the frame at right angles to the face of the head. The main shaft is fitted with an automatic stop clutch. The weight of the ram is counter-balanced by heavy springs.

The driving gears are assembled on the housing in a self-contained unit, which saves considerable floor space. The driving motor is mounted on a bracket at the rear of the machine. The automatic stop clutch is operated by an electric solenoid with remote push-button control.

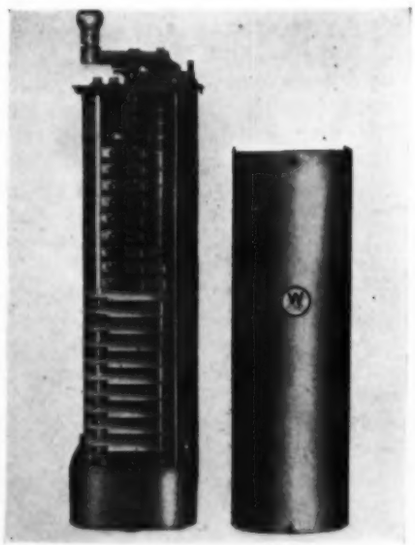
The punch is of all-steel construction, with bronze-lined slide bearings, bronze-bushed shaft bearings, and is fitted with a single-shot forced-feed lubricating system. The general specifications of the tool space are: Length of head from front to back, 60 in.; right to left, 12 to 40 in., as required; distance from the face of the head to the table, stroke down, 48½ in.; stroke, 3 in. The capacity of the machine is 400 tons pressure, or it will punch four 1⅛-in. holes through 1-in. material in a cluster at any point of the head, front to back. The use of the toggle to operate the head reduces the size of driving gears and the horsepower of the motor, and consequently saves in power consumed. Several sizes of presses are being manufactured, ranging in capacity from 150 to 600 tons. The 400-ton machine illustrated weighs 80,000 lb., when packed for shipment.



Beatty 400-Ton Heavy-Duty Toggle Press which will punch four 1⅛-in. holes in 1-in. material

Westinghouse Type A Reversing Drum Controller

A line of reversing drum controllers, known as Type A, is announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These controllers are listed in classes 8,300 and 8,400 for d.c. service, and in classes 12-700 and 12-800 for a.c. service. They are designed for operating cranes, hoists, bending rolls, railway turntables, and other heavy work. Ball thrusts make operation easy.



Westinghouse Type A Reversing Drum Controller

The drum cylinder consists of rolled brass supporting disks assembled on a micarta insulated steel shaft between brass and micarta insulating collars. The contact segments are bolted to the supporting disks in a manner to prevent burning of the bolt heads. The segments are reversible. The fingers are of the compensating, self-aligning type for square alignment on the contact segments. An adjustment is provided to compensate for finger wear.

Several types of operating heads can be used. The horizontal handle

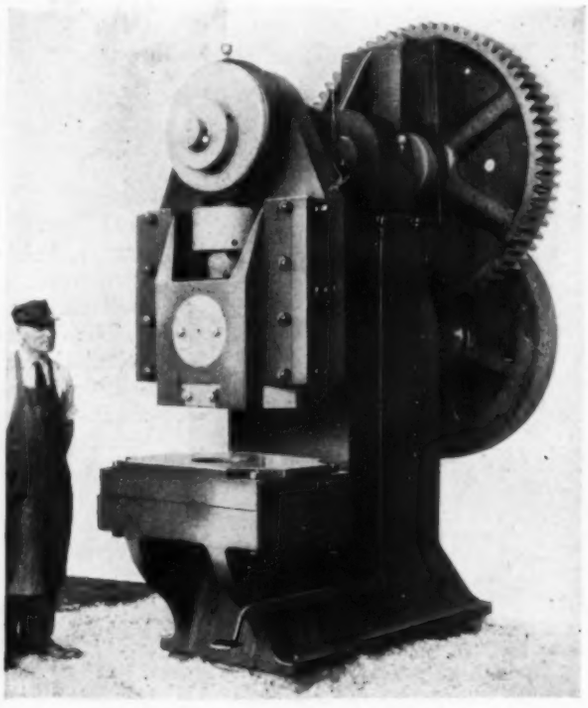
with spring return, the standard horizontal, the vertical handle, the bevel-gear head for right-angle drive, and the rope wheel with or without spring return, all can be mounted in any of four positions on the controller top.

Castings have been replaced by steel parts in the controller, wherever practicable, to provide maximum strength with reduced size. The wiring is simple because of the removable back cover, the ample wiring space behind the rotating contacts, and the large opening in the base. A safety latch is located in the handle so that it cannot be moved by an accidental knock, and a handle lock prevents anyone from tampering with the device.

Williams-White Improved Series Punch Presses

AN IMPROVED series of punch presses has recently been placed on the market by Williams, White & Company, Moline, Ill., for particular use in punching, blanking, piercing and drawing operations. Sturdy construction and a minimum of floor space are featured. The illustration shows the No. 66 punch press.

In each instance the frame is a one-piece, semi-steel casting of box section. The main bearings are bushed with bronze, and the shaft is a hammered forging of special analysis steel. Automatic-stop, steel-jaw clutch with treadle control is regularly furnished. Each size of machine is single geared, and the gears are made of cast steel with the teeth machined from the solid. For additional strength and safety webs are cast between the spokes of the flywheel and gear. The particular machine shown, the No. 66 size, was designed to punch a blank 10½ in. in diam. through ⅜-in. high-carbon steel, and is provided with a hole in the bolster to permit the blank to pass through without interference. This hole is centralized in the bolster plate which measures 24 in. front to back and 36 in. in width. This particular machine is built with a 3-in. stroke, although it is arranged so that, by means of another eccentric, a 6-in. stroke can be obtained. The die space, that is, the distance between the bed and the slide with stroke up and adjustment up, measures 16 in. An adjustment of 3 in. is provided by means of a screw on the connecting rod between the eccentric and the slide. The machine weighs approximately 25,000 lb., and is capable of exerting a pressure of 200 tons at the dies.



Williams-White No. 66 Punch Press

"O.K." Cutter Blade Holders

A LINE of cutter blade holders has been placed on the market by the O.K. Tool Company, Inc., Shelton, Conn. These holders use the serrated blade formerly called the "fine tooth type blade," and have been developed, it is claimed, to cover all kinds of metal-cutting operations, including milling and broaching.

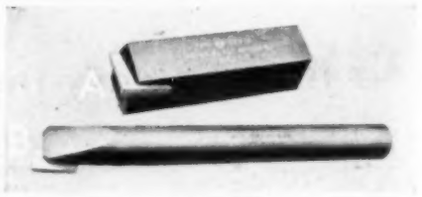


Fig. 1—"O.K." Straight-Blade Cutter Holder at A and Cutter-Blade Boring Bar at B

The "O.K" cutter blade has fine serrations upon one side and is made with a 5-deg. taper, which locks it securely in its holder. In addition, owing to the fact that there are no locking bolts, the tool can be set with so little overhang that the tool block also grips the cutter.

A holder used for standard lathes and screw machine turrets is shown at *A*, Fig. 1. The serrations are so placed that the adjustment is in the direction of greatest wear. The cutter blade boring bar is shown at *B*. The blade may be ground to cut a specific hole size, and when worn, it may be set over one serration and ground again. In Fig. 2, is shown a holder of the offset type at *A* and at *B*, how little overhang is necessary on either end- or side-cutting tools.

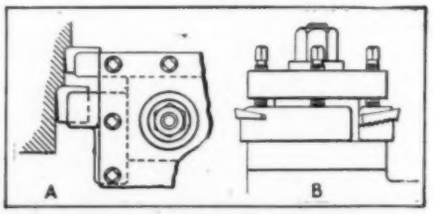
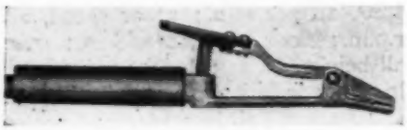


Fig. 2—Adaptation of "O.K." Cutters to different holders, and the methods of holding

The holders are made in sizes to accommodate standard toolposts and turrets, while the boring bars range from ¾ to 2½ in. in diam. Cutter blades are sized in proportion.

General Electric Welding Electrode Holder

The General Electric Company, Schenectady, N. Y., is producing a clamp-type electrode holder to supplement its line of electric arc-weld-



General Electric Welding Electrode Holder

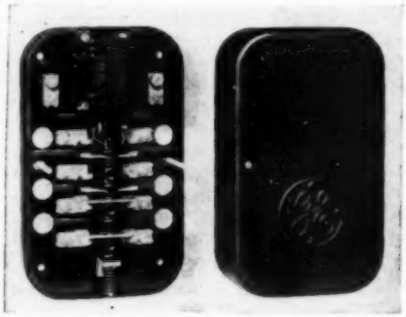
ing equipment. This device has heavy copper-alloy jaws, notched to hold firmly any size of electrode wire from $\frac{1}{16}$ to $\frac{1}{4}$ in. in diam., in any position.

The operator is protected from heat and from contact with current-carrying parts by a molded-compound handle. The holder is designed for use with currents up to 300 amp. It may be obtained, if desired, with 5 ft. of extra-flexible cable and a terminal.

General Electric Multi-Finger Relay

The General Electric Company, Schenectady, N. Y., has placed on the market a relay, CR-2820-1080, designed to meet the demand for a multi-finger, alternating-current device for general-purpose use. On mechanisms, this relay could be used as an interlocking device between motions, where, for example, it is undesirable to have one motion operating at the same time as another motion, or unless a second motion is operating.

The relay consists of a series of double-break, silver-faced fingers operating horizontally and controlled by a small solenoid. The power consumption of the solenoid coil is 8 watts. The complete assembly is on a molded base over which fits a drawn-shell cover. The base is provided with holes through which leads may be run when the relay is mounted as a panel device. Clearance for 550 volts has been provided. The contacts will carry 15 amp. continuously.



General Electric Multi-Finger Relay

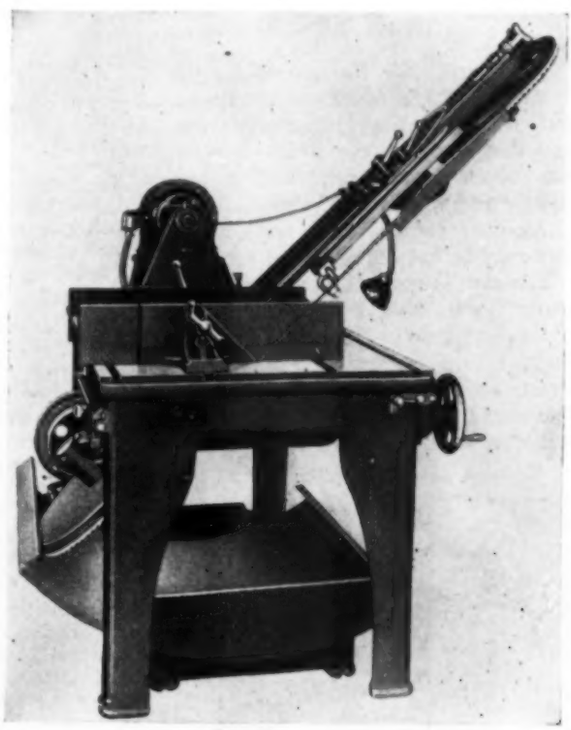
By varying the arrangement of the contact fingers, the relay may be arranged for a number of different types of application, as follows: Four fingers normally open; three fingers normally open, one closed; two fingers open, two closed; three open; two open, one closed; one open, two closed; two open; one open, one closed; two closed.

The relay may be used when a number of independent circuits are to be controlled remotely and will be useful on signal and indicating circuits and emergency throw-overs.

Armstrong-Blum No. 8 Metal Bandsaw

THE Armstrong-Blum Manufacturing Company, 357 North Francisco St., Chicago, Ill., has made a number of important improvements in its No. 8 "Marvel" metal bandsaw. Chief among these improvements is the automatic power feed control by which the pressure of the saw blade can be set and maintained at the figures recommended by the company for given classes of work.

The feed drive, located at the motor end, consists of a friction disk clutch taking power from the main-drive motor. This clutch and the feed drive-shaft are held in engagement by means of a graduated counterbalanced arm conveniently located at the operator's position. When the counterweight is set at the proper point, as recommended on a saw chart furnished with the machine, it will hold the clutch in driving position until the correct pressure is built up as the saw moves into the work, and will rise to disengage the clutch before excess pressure can do any harm. Hand control of the feed or carriage travel is also provided by throwing the trip located at the operator's position, as illustrated.



Armstrong-Blum No. 8 Metal Bandsaw

The machine is equipped with standard ball bearings inclosed in Alemite-equipped housings, ground shafts, feed worm and worm gear inclosed and running in oil, quick-action ball handle to eliminate use of wrenches in making set-ups, a centrifugal pump for the cutting lubricant, and electrical equipment, including automatic motor-starter, push-button station, and a limit-switch, which can be set as a depth gage to stop the motor automatically when the cut is completed, or any desired depth of cut has been reached. In addition, a lighting fixture has been attached to the machine carriage, located to eliminate shadows.

The machines can be furnished belt-driven, or motor-driven, for attachment to any power or lighting circuit. They will handle work from the smallest material up to large, solid bars or shapes 18 in. in diam., or 18x20 in. square, of any length, and make both straight and angle cuts. Conveniently-located degree

graduations on the machines give instant setting for any desired angle without laying out the work, a means of saving time.

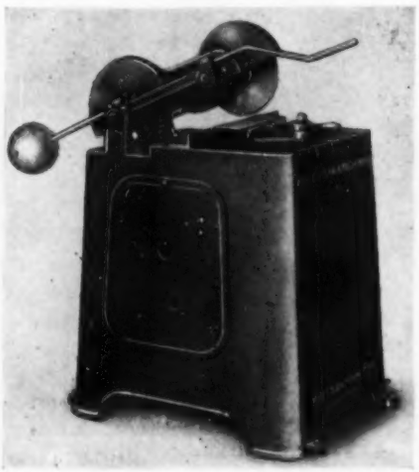
Allen-Bradley Bulletin 701 A.C. Contactor
Erratum

In the announcement of the Bulletin 701 a.c. contactors manufactured by the Allen-Bradley Company, 286 Greenfield Ave., Milwaukee, Wis., it was incorrectly stated that aluminum contacts were used. This should have read silver contacts. All switch parts are cadmium plated to prevent corrosion. The switches can be provided for operation on 6, 12, 24, 110 or 220 volts, and for any frequency from 25 to 60 cycles. Current ratings range from 15 to 30 amperes.

Hunter No. 4 Metal Cutoff Saw

The cutoff saw introduced by the Hunter Saw & Machine Company, 57th & Butler Sts., Pittsburgh, Pa., was developed to cut brass, bronze, and copper shapes, solid and tubing, rapidly and with a minimum of burr. Three-inch round brass and copper bars may be cut off in 3 to 4 seconds.

The saw is mounted on a balanced tilting frame, and is fed through the material by an offset hand lever. The blade is driven by a 3-hp. motor through a roller chain and sprockets. The mechanism holds the chain at the best working tension. The saw guard tilts out of the way to facilitate saw removal. The motor and starter are completely inclosed in the base. The work is clamped with a quick-acting eccentric vise. Angle cuts as well as straight cuts can be made on the machine.



Hunter No. 4 Metal Cutoff Saw

Specifications: Capacity, rounds, 3 in., over-all section, 5x1¾ in.; diameter of blade, 10 in.; peripheral speed, 1,300 ft. per min.; arbor speed, 525 r.p.m.; floor space, 24x48 in.; over-all height, 45 in.; height to table, 31 in.; net weight with standard motor and starter, 950 lb.; standard motor, 3 hp., two- or three-phase, 60-cycle, 1,800 r.p.m., 220, 440, or 550 volts; optional motors 3 hp., d.c., 1,800 r.p.m., or 3 hp., 25-cycle a.c., 1,450 r.p.m., 220 or 440 volts.

REVIEW · OF · RECENT · PATENTS
Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

Patent 1,717,431 assigned to the Rivett Lathe & Grinder Corporation covers a bench lathe with a countershaft having a belt guard, a movable support for the countershaft on the belt guard and means for adjusting the belt tension by moving said support.

An electro-plating machine for strip stock is the subject of patent 1,717,460 granted to Joseph J. Mascuch of East Orange, N. J. It comprises a vat having two rows of rollers, one above the other, the stock to be plated being passed alternately over rollers in each of the two rows.

To the Lewis Foundry & Machine Co. has been assigned patent 1,717,586 relating to a forming mill with a base, a pair of housings having two cooperating spindles, a driving shaft with a wide helical gear and a novel arrangement of other gearing.

The General Motors Corporation is assignee of patent 1,717,634 covering a machine for removing the flash from a metallic structure, and comprising a support with a die movable with respect to the support, resilient means for holding the die in a predetermined position, a reciprocal element adapted to move with the die against the resilient means and a cutting element adjacent to the path of the die.

A grinding machine, covered by patent 1,717,899 assigned to the Sundstrand Machine Tool Co., comprises a work table, automatically movable, a work carrier vertically slidable on the table, suspension means pivoted on the support to swing through an arc and means to hold the table in any position against the tendency of gravity to move the carrier to the lowermost position on the arc.

Patent 1,718,067 assigned to the Kearney & Trecker Corporation comprises a milling machine with a tool support, means for moving it in a number of paths and including a plurality of transmission trains respectively connectable each having a quick-traverse clutch element and a reverser arranged to operate successively in series.

Two patents, 1,716,424-5, have been assigned to Alexander Herz of New Rochelle, N. Y. The first of these covers a tube-forming machine having a stationary mandrel, means for forming a tube thereon and for feeding the formed tube, means for guiding the tube in a predetermined path and for cutting it off into predetermined lengths. The second patent covers a similar class of machine, but with a cutting element that moves at constant speed in a fixed plane in such a way as to sever the tube without distortion.

TRADE PUBLICATIONS

Auto Mechanics Service Book. The South Bend Lathe Works, 666 East Madison St., South Bend, Ind., has published bulletin No. 66 entitled "Auto Mechanic Service Book," which shows modern machine methods in the service station shop and gives a list of machines and attachments manufactured by the company for this work.

Gear Inspection Device. The Fellows Gear Shaper Co., Springfield, Vermont, has published a catalog entitled "Red Liner for Automatic Gear Inspection," describing a machine for charting automatically a permanent record of errors in gears at conditions closely approaching those of actual operation.

Polishing Equipment. The Mitchell Engineering Co., Springfield, Ohio, has published a bulletin illustrating and describing several types of polishing, buffing, and grinding machinery. The specifications are listed. The company has also published a bulletin on "W & P" threading and special tapping machinery, illustrating the line and giving output data.

NEWS
OF THE WEEK

Industrial Alsace Now Competing with French Manufacturers

Mechanical Trades of Alsace Making Remarkable Progress

By Our Paris Correspondent

THE INDUSTRIAL and economic history of Alsace, now become French again as the result of the Treaty of Versailles, has ever been closely allied with political events. But leaving politics apart (and the political issues even now between the mother country and the re-incorporated province are still at the point of high racial passion), the industrial capacities of Alsace and its highly skilled workers have brought into the general scheme of things so far as France is concerned a spirit of, if not jealousy, at least envy. In fact, it means just so much production capacity thrown into the French balance to compete with the old line French manufactures in the metal-transforming trades.

One of the important features is the development of the Société Alsacienne de Constructions Mecaniques at Graffenstaden, an old French foundation dating from 1828, but for twenty years working under the German régime in power. A minor company at Bischwiller actually produced one of the first locomotives employed on the French railway system. The Koechlin firm who had this effort to its credit combined and founded the Graffenstaden concern, specializing at the time in the decimal weighing machine and railway and other heavy-lifting equipment. In 1855 it began the manufacture of locomotives and in 1879, after the Franco-Prussian war, founded a branch factory at Belfort, later specializing in heavy electrical equipment, this latter now being supported by the puissant "Alsthom" concern, an offshoot of the French Thomson-Houston Company.

The Graffenstaden firm is still working at high pressure, and has, to date, turned out 3,000 locomotives and innumerable heavy units in weighing, conveying, and elevating machinery.

At Strasbourg are important plants turning out refrigerating machinery, brewery equipment, hydraulic machinery, and mill supplies, to say nothing of important steel furnaces and rolling mills.

Selestat produces wire-cloth screening in vast quantities. The small tool industries are centered at Mutzig and Saverne. The foundry industries, making castings to order for various fabricating industries, are centered at Niederbronn, Reichshoffen, and Mertzwiller. Here they specialize on railway equipment accessories and parts, steel tires, tanks, reservoirs, boilers, and heating installations.

Two famous marques of Automobiles listed in the French stud-book, the Mathis and the Bugatti, have given a pre-eminence to this phase of the transforming metal industries which have brought these products to the very front rank. If their output is not large it may at least he said that the Mathis plant at Molsheim is a model installation.

The textile industry of Alsace is of prime importance and various small manufacturers and others of considerably greater expansion are producing highly efficient machines for this trade, exporting even abroad. It is recorded that the first textile printing machine (the first to utilize the engraved copper roller or cylinder) dates from 1805.

Transport facilities are highly developed, the Alsatian Railways running north and south with branches entering all the important valleys of the Vosges where many of the manufacturing industries are located. Heavy traffic by the Rhine waterway and connecting canals has given importance to the port of Strasbourg. In 1913, under German rule, the traffic totalled 1,980,000 tons, today it is 5,350,000 tons per annum.

Electrical energy is highly developed throughout the province, and with plans in projection this will be greatly increased in a few years to come when, without doubt, it may be claimed that of all industrial centers in France that of Alsace will prove to be very nearly the ideal for many industries depending upon production power and efficient transport. Communication with tide water by the lower Rhine to Rotterdam and Antwerp is facile and economical, while the canal which runs from the Rhine to the Marne directly reaches the center of France.

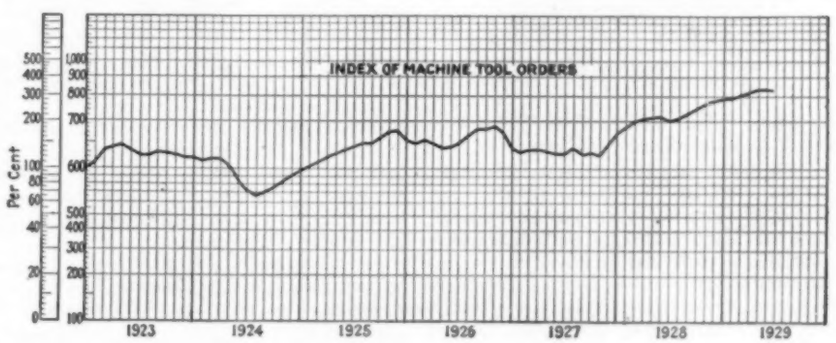
The petrol industry of Pechelbronn is not a great producer as to bulk, but is virtually the sole output of western Europe. Production approximates 70,000 tons per annum. The potash deposits are of the greatest importance, annual production having (in 1927) risen as high as 2,322,910 metric tons.

* * * *

Slight Drop in Machine Tool Buying

Order Volume Maintains a Good Level, However, and Entire Situation Is Favorable

TENTATIVE figures for June orders of machine tools indicate a slight falling off, according to Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, but the volume of orders still maintains a satisfactory level in spite of seasonal influences. He supports the belief that the substantial earnings which industry has been enjoying have been largely responsible for maintaining the machine tool demand, and will continue to support it throughout the year. Actual earnings of industrial



corporations during the first quarter of 1929 were 35.7 per cent higher than those for the corresponding quarter last year, while, if U. S. Steel and General Motors are omitted from the compilation, the other industrial corporation earnings show the gain of 44 per cent over the same quarter last year.

The growing belief in the economy of using modern tools in place of obsolete machines has also contributed materially to the sustaining of business volume. There are but few factors which might indicate that any drop of consequence will occur, credit uncertainties being the major factor to consider at the present time.

There seems to be some evidence of a danger of car shortage, particularly in flat cars. The fuel and material situations will probably remain as they are for the remainder of the half, and there seems little evidence of an increase in demand for either material or fuel.

As anticipated, the month of June reflected a seasonal tendency toward a slackening in the orders volume, and the falling off has been sufficient to accelerate slightly the down-turn of the 3-months average index which was indicated in May for the first time since the summer of 1928. Even so, the rate of recession is not alarming, and so far as can be interpreted at the present time, it cannot be looked upon as a signal that the period of good demand that the industry has been enjoying for the past twelve months is over.

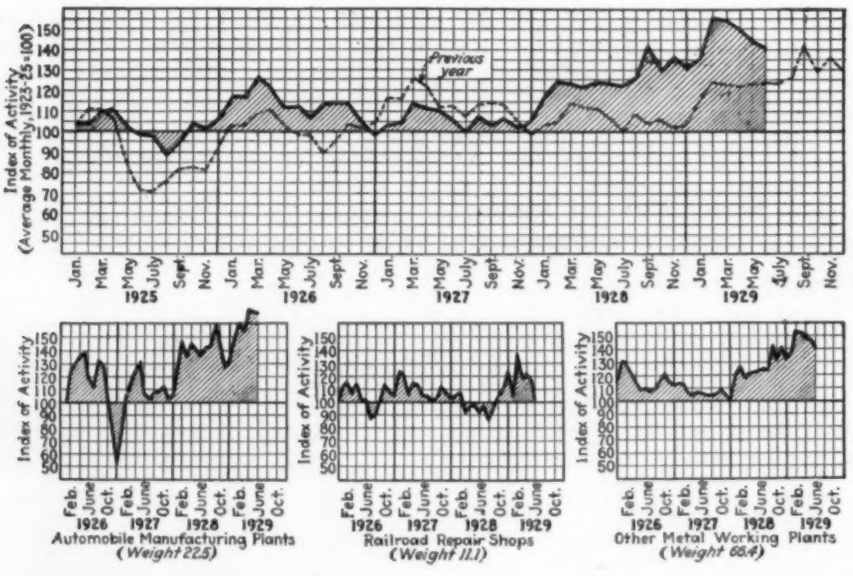
* * *

According to "Domestic Commerce" the journal of the U. S. Department of Commerce, the annual value of waste metals collected, sorted, and shipped is more than a billion dollars a year. Over 5,000,000 tons of ferrous, or iron, scrap is collected and sold annually, exclusive of the scrap of steel mills, railways, and large manufacturing plants.

* * * *

Record Operations for First Half Year Reported by Metal-Working Plants

THE first half of 1929 was marked by the highest average rate of operations in the history of the metal-working industry. The rate during the six-months period was 16.5 per cent higher than that for the same period of last year, and about 31.2 per cent higher than that of the first half of 1927. The peak of operations during the current year appears to have been reached in February, since which time there has been a gradual downward trend.



Incomplete returns on the consumption of electrical energy indicate that June operations were 2.3 per cent under those of May, but 13.2 per cent over those of June of last year.

Automobile plants were operating during June on a slightly lower level than that during May, but were still on a level 17 per cent over that of June of last year. The peak of operations in these plants appears to have been reached in April, since which time the rate has dropped 6.5 per cent.

The ferrous and non-ferrous metal-working plants appear to have continued their slow decline which started in March. The monthly decrease, however, has been materially less than that which would be normally expected at this season of the year. June operations in these plants were about 2.5 per cent under those of May, but were 13.5 per cent over those of June of last year.

Activity in the railroad repair shops during June, while about 2.7 per cent under that of May, was on a plane 11.5 per cent over that of June of last year.

June Employment Increases In Ohio Machine Industry

The Bureau of Business Research of Ohio State University, in a preliminary bulletin covering employment in the machinery industry of Ohio, shows that June employment was slightly greater than that of May this year and 16 per cent greater than the employment in the industry in June, 1928.

Average employment in the machinery industry during the first half of 1929 was 15 per cent greater than that of the corresponding period in 1928.

* * *

Iron and Steel Division Will Hold Fall Meeting

The Iron and Steel Division of the American Society of Mechanical Engineers will hold its annual fall meeting in Cleveland during the week of September 9 as a part of the National Metals Congress in that city. The following papers of interest to *American Machinist* readers will be presented at the meeting: "Non-destructive Tests of Welds," by Elmer A. Sperry, President A.S.M.E.; "Foreign Practice in Welding Boiler Tubes and Drums," by George A. Orrok, "Automatic Arc-Welding of Thin Sheets," by W. L. Warner, Industrial Heating and Welding, Engr. Dept., General Electric Co., Schenectady, N. Y.; "Alloy Steels in Iron and Steel Mill Equipment," by M. J. R. Morris, Central Alloy Steel Corporation, Massillon, Ohio; "Evolution of Drives for Mill-Table Rollers," by K. W. Feller, Branch Manager, Schleemann Engineering Corporation, Pittsburgh, Pa.; "Distribution of Heat in Combustion Furnaces," by M. H. Mawhinney, Electric Furnace Co., Salem, Ohio.

* * *

American Welding Society Announces Fall Papers

Papers to be presented at the annual fall meeting of the American Welding Society were announced recently by the Meetings and Papers Committee. The meeting will be held in Cleveland the week of September 9, as a part of the National Metals Congress.

The papers to be presented by the American Welding Society of interest to the metal-working industry, are as follows:

"Non-destructive Tests of Welds," by Elmer A. Sperry, Sperry Development Co.; "X-Ray Investigation on Welds," by Dr. H. H. Lester, Watertown Arsenal; "Welding of Copper and Copper Alloys," by Mr. Hook, Research Laboratory, American Brass Co.; "Welded High-Strength Aluminum Alloys for the Aircraft Industry," by Mr. Dawson, Research Laboratory, Linde Air Products Co.; "Stress-Strain Characteristics of Welded Joints," by Prof. J. H. Smith, University of Pittsburgh; "Cutting and

Welding Steel Parts to Replace Castings," by W. J. Buchanan, The Bessemer Gas Engine Co., Grove City, Pa.; "Testing Equipment Used in Welding Industry," by V. G. Tatnall, Southwark Foundry and Machine Co.; "Machinery Design as Influenced by Electric Welding," by H. G. Boist, General Electric Co.

* * *

First National Census On Distribution Planned

Policies governing the conduct of the First National Census of Distribution were formulated at a meeting of an Advisory Committee in Washington, July 11. This committee was appointed by Secretary of Commerce Lamont.

The object of the census is to present a complete picture of domestic commerce in the United States. Therefore, the task faced by the Census Bureau is to produce not simply figures on the volume and value of inter-industrial, wholesale, and retail trade, but also to provide comprehensive statistics properly correlated with industrial and merchandising operations. Practically all of the members of the Advisory Committee on the distribution census are men who have been working with the Department of Commerce for several years past on various phases of its program for the elimination of waste in distribution.

* * *

Railroad Purchases $1,271,341,000 in 1928

According to an analysis made by the Bureau of Railway Economics of "Capital Expenditures and Purchases in the Railway Industry," Class I railroads purchased fuel, materials and supplies having a total value of $1,271,341,000 in 1928. This was a decrease of $124,587,000 under 1927, or 8.9 per cent. During the six-year period which ended with 1928 the railroads expended $8,700,000,000 for materials and supplies, or an average of $1,450,000,000 per year.

The purchases of iron and steel products entering into the above total were $397,544,000 in 1928 and $432,604,000 in 1927. In addition, railroads are indirect purchasers of many commodities, large quantities of which go into railway equipment and new construction contracted for under lump sum agreements, and not classified under the head of direct purchases.

* * *

Yale & Towne Buys Stuebing Cowan Company

The Yale & Towne Manufacturing Co., Stamford, Conn., has contracted to purchase the good will and assets of the Stuebing Cowan Co., Cincinnati, Ohio, according to a recent announcement of the companies. The two companies will be merged at once, the executive personnel of the Cincinnati concern entering the employ of the Stamford company. The reported purchase price is $2,057,920 or 27,256 shares of Yale & Towne stock. Stockholders of the Stuebing Cowan Co. are to decide which they will accept on July 29.

The merger brings together two of the larger manufacturers of hand and electric lift-trucks to create the largest concern in its particular field in the world. James C. Morgan will remain in supervision of sales of material handling equipment, assisted by Walter C. Stuebing of the Cincinnati company.

American Pulley Company Takes Over Sprucolite

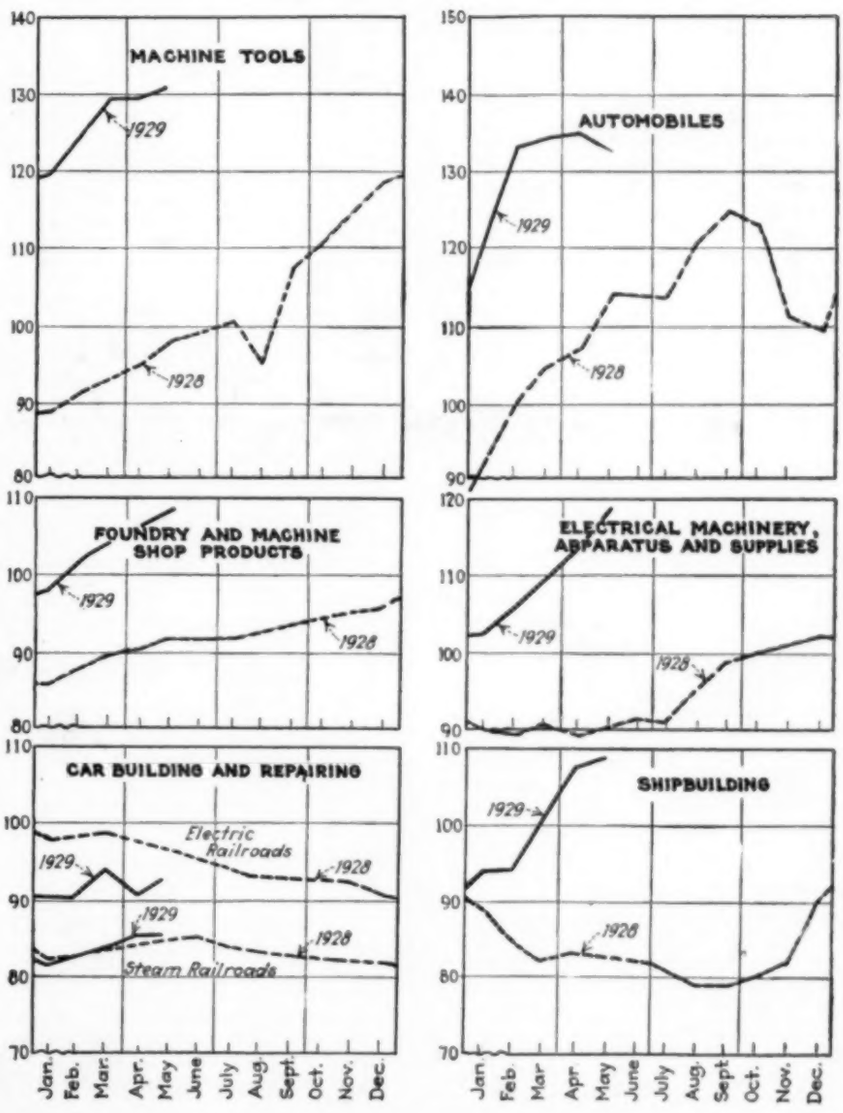
The American Pulley Co., Philadelphia, manufacturer and distributor of American steel split pulleys, pressed steel hangers, and pressed steel hand trucks, has taken over the exclusive distribution of the products of the Sprucolite Corporation, Bloomfield, N. J. The new line will be known as "American Sprucolite Pulleys," and will be distributed through the regular American Pulley Co. warehouses. "Sprucolite" is made by the compression of impregnated, laminated spruce wood.

* * * *

Trend of Employment in the Metal-Working Industries

Data Supplied by the Bureau of Labor Statistics

Monthly average for 1926 = 100



BUSINESS BAROMETER

Stock market advances continue as a result of rumors and announcements of mergers in high circles

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

"WHAT do two and two make?" asked a proud father of his little boy. "Twenty-two," answered the lad. "Why, son, don't you know that two and two make four?" queried the father. "Well, Dad, that depends upon the way you put them together," answered the youngster.

This old story is appropriate to the present situation in the United States. In almost every line of business it is assumed that two and two make twenty-two, and that by putting properties together their value can be multiplied many times over. Hence, a further advance in the stock market has occurred, based upon rumors of consolidations and mergers that are almost fantastic.

One example is a proposal to form a huge trust that shall include all the power plants in the United States. It has been seriously discussed in high quarters. Another is a plan that contemplates assembling all the railways of the United States into five great corporations, and a third is a huge merger that will include most of the chain-store organizations already formed.

Although it seems unlikely that any of these proposals will be realized in the near future, they have served to fire the speculative imagination, and have encouraged the buying of stocks. The result is that all the published "averages" have ascended to new highs, and the demand for credit to carry these purchases has pushed the total of brokers' loans through the previous peak reached last March. Bank loans upon collateral also have retraced their previous decline, and if there was reason last winter for the concern which most bankers expressed over the dangers of the speculative absorption of credit, there would seem to be equal cause for apprehension now.

But it must be admitted that no such concern seems to be felt. One reason is that the financial world is becoming habituated to stock prices which represent a more extravagant capitalization of earning power than was formerly thought safe. Another is that the prices which aroused apprehension last winter now appear so cheap in retrospect, and have been so well justified by the astonishing maintenance of business at such high levels and the increase of corporation profits during the first half of the year, that few of the conservatives still have the courage publicly to reiterate their bearishness.

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

REPORTS from various industrial centers seem to indicate that the machine tool and machinery business is in most cases still steady, although New England and Detroit report a slight falling off.

ELECTRICAL, sheet-metal, radio, airplane, and the railway industries are buying in New York, and inquiries are out in the locomotive field. Many dealers report July as good as June. Chicago reports that business in some cases is better than it was in June. There was a 50 per cent gain during the first half of the year over the same period in 1928.

INDIANAPOLIS dealers are busy supplying the road builders, utilities, and the sand and gravel industry with special equipment, even thought the demand from the automobile industry has fallen off slightly. Railways are the most consistent buyers in Canada, having made purchases of over $75,000,000 during the past eight months. The automobile and agricultural machinery business are also holding up well. In Cincinnati, a slight lull is expected, but sales and orders are maintaining a good level. Detroit reports a general depression during July, with the small shops doing jobbing work reducing their schedules, and automobile and accessory plants busy but not buying. The Packard Motor Co. placed an order for $150,000 with one firm and several smaller orders with others. New England reports a slowing up of machine tool sales, but a heavy demand for grinding units.

And, finally, it is true that as the outlook for the second half of 1929 has been clarified it appears more favorable than the earlier forecasts anticipated. The reserve position of the Reserve System has been strengthened by its increment of gold and borrowers are discovering that the Banks are no longer quite as adament in guarding against rediscounting as they were a few months ago. This modification of their policy undoubtedly is carried out with an eye toward crop moving and autumn commercial demands for credit, and those "in the know" believe these demands will be supplied freely at present rates, and that some softening is possible if the stock market is not too presumptuous in its demands.

Those who were trained in the prewar school of business find it difficult to believe that the country's trade and industry can continue to be unaffected by the repressive influences that have developed and are developing as a result of the speculative distention. But it must be admitted that there is nothing in current statistics to warrant the fears of the conservatives, and the demand for staple merchandise, as well as for luxuries, continues active. Retail trade is the largest on record, and if a satisfactory farm purchasing power is added to that of the industrial population, the fall trade should be the most active the country has ever known.

The maintenance of such high industrial activity confounds the forecasters who expected more than a seasonal recession, and they are now projecting their prophecies of reaction further into the future and applying them to 1930. The steel industry is still almost at capacity and is still going so well that some are commencing to believe its presumed over-capacity a myth. If that is the case the "pauper" will have to be eliminated from the old saying that "steel is either prince or pauper."

The production of low priced automobiles is but little below its peak, though the output of higher priced cars has declined considerably. The building industry is about the only one in which there seems to be any contraction, and the upward trend of most commodities is maintaining confidence.

Aside from the imbroglio in which Russia and China are involved, the foreign situation seems to be satisfactory. It appears likely that Poincare will be successful in getting the French Parliament to ratify his settlement of the debt due the United States, and when this ratification is secured, the way ought to be open for the final adoption of the Young Plan and the establishment of the Bank of all Nations from which so much is hoped.

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THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

The slump that two or three machinery concern executives anticipated would overtake the machine tool business in July has not materialized. On the contrary, business up to the fifteenth of the month is reported by some manufacturers' representatives and large distributors as improved over the first half of June, and inquiries pending indicate that, at least for some weeks to come, there will be no change in conditions. Totals of sales for the first half of 1929 having in several cases been tabulated, it is now possible to state with a fair degree of accuracy that the gain over the same period of 1928 will not fall short of 50 per cent on the average. In some instances, it will run much beyond that. To quote an example: The Chicago representative of one of the largest machine tool builders located in the middle western territory informed the writer that the total sales of his company up to the end of June this year were within $20,000 of being double that of the first half of 1928. Others reported similar, though not quite so impressive, gains. Present business is coming from scattered sources, a large part of it from the Chicago industrial area. No change has been noted in the character of railroad buying, which continues on about the same level as for the last two or three months.

CANADA

While many economic factors have contributed to the prosperity of the metal-working industries this year, railway requirements have played an important part. Orders placed by the Canadian railroads for locomotives, freight and passenger cars in the past eight months, are estimated at approximately $75,000,000. This has meant tremendous activity among railway equipment companies and many allied lines, and in itself has proved a splendid stimulus to business.

Iron and steel companies all report increased activity. A large order for steel rails has just been placed by the Newfoundland Government with the Dominion Iron and Steel Co. The order is for 11,000 tons and is the second secured for rails from the Newfoundland Government. Operations at the steel plant are proceeding at a high level, with 2,650 men employed. The Algoma Steel Corporation has received an order from the Canadian Pacific Railway for a large tonnage of steel rails which, with other contracts on hand, will keep the mills running at double shift until the end of August. The Dominion Engineering Co., subsidiary of the Dominion Bridge Co., has found it necessary to create a night shift to keep up with the work on hand.

A contract for the construction of a bridge over the Welland canal has been awarded to the Hamilton Bridge Co. The amount of the contract totals $163,000. An order for 15 street cars for the British Columbia Electric Railway, involving a total outlay of $300,000, has been placed with the Canadian Car and Foundry Co. Delivery is to be made in October. The automobile business of the National Steel Car Co. is reported to be netting the company good returns. Important contracts have been entered into recently with a number of companies for automobile frames.

The outlook for agricultural machinery manufacturers is considered fairly good. Sales of the Massey-Harris Co. in the first half of the company's fiscal year are reported to be about 15 per cent greater than in the corresponding period of the previous year. The Cockshutt Plow Co. has just completed the first six months of its current fiscal year, and the sales during that period, both domestic and export, are said to have been greatly in excess of the same period last year.

SOUTHERN DISTRICT

The first half of July witnessed a slight improvement in machinery and machine tool sales in the southern territory, though considering the present business as a whole, dealers state that it is not as large as at this time last season. Nor is the inquiry as heavy as at this time last year, hence comparatively few of the firms are expecting any marked activity in demand during the summer months. For the first six months of the year, sales were somewhat better than they were during the corresponding period in 1928, most dealers report.

The textile industry continues to place quite a few orders for new equipment for use in various large textile mills that are now being erected in the Southeast, but sales have slowed up a little the past two or three weeks. However, inquiry is brisk and as there is a large amount of new mill construction still under way in this district, demand is expected to continue well in excess of last season.

In the woodworking field machinery demand is exceptionally dull, and though a few orders are being reported, the business for the most part is spotty and considerably less than at this time last year. Some demand is still being reported for road building machinery, but this line also has been showing a tendency to decline the past two or three weeks, though it continues to exceed last year. Railroads are still placing some fairly good orders for heavy shop equipment, and having shop building projects under way in various parts of the Southeast are expected to continue fairly active in this market. Few sales are reported to garages and smaller machine shops, and such orders as are being booked are mostly for used or rebuilt equipment.

NEW ENGLAND

Machine tool sales have slowed up somewhat in the New England market; and the industry, while still maintaining a strong industrial activity and holding to a fair volume of new business, is nevertheless at its lowest level of the year. This mid-summer condition has afforded manufacturers the much needed opportunity to catch up. Eight weeks' delivery, however, is still required for most standard equipment.

The demand for grinding units of all types is heavy, and is an impressive factor in New England trading. Builders of this equipment are very busy, and report a good export trade as well as a heavy home consumption. A good percentage of the latter orders are from airplane and engine manufacturers.

This machine tool district is better than seasonably active, and inquiry, while showing considerable let up, is fairly steady. Textile machinery is moving well, and the industry is holding to gains made during the spring months. Small tool manufacturers because of the prolonged heavy demand are low in stocks. A Bridgeport airplane interest has placed orders for shapers and lathes, about eight machines in all. Lathes and drills are selling well to automobile service stations, and that poter.tial market is very good at this time.

INDIANAPOLIS

With the factories busy until fall and even later, there is a marked spirit of optimism in the local market. The summer slump has not occurred.

Only one or two dull spots seem to be noticed. Demand from the automobile field is not as active as it was. This was expected and there is no pessimism on this score. The factories have caught up with the production in their new models this year and their sales now are limited entirely to the current demand, dealers having been supplied. This is not true of all the Indiana factories, but is true largely in Indianapolis.

A large volume of special equipment is being sold now to the sand and gravel industry. Some dealers say business in this line is the best in years. Several of the central Indiana plants are making numerous replacements and additions. The same is true of the crushed rock industry, which is one of the largest in the state. Much the same condition prevails in the large cement mills. The pretentious road building program of both state and counties is responsible for this. By the same token the demand for road contractors' equipment also is heavy. Due to so much rain during April, May, June, and the first two weeks of July, road contractors have been held up and with a time limit placed for completion of jobs, they are buying more equipment to hurry work along. The electric and gas utilities are providing another source of demand. The electric utilities are making many additions and replacements and the same is true of the gas utilities.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that during the past week business was at a good level, when the season is taken into consideration. While some had a slightly less volume of sales than in the previous week, others had a slight gain, and therefore, when the trade is taken as a whole, the level remained about the same as it had been.

Typical comments made by manufacturers were as follows in substance: "Business is very good, taking the season into consideration, and the indication is that it will remain at a fair level during the coming month." "As yet we have had no seasonal lull of any consequence, and orders are coming to use in about the same volume as they have been." "Business with us is better than fair—you might say that it is excellent for the season." "We have had a slight lull, but in spite of that the demand remains good for the season."

Selling agents report that during the week business held up well in local and adjacent territory. The consensus in this branch of the trade is that while there probably will be a lull in the coming month,

business will not drop off to a serious extent.

The great majority of the orders and inquiries in the past week were for single tools and replacements. These came from general machinists and miscellaneous users, located in all sections of the country, whose requirements were well diversified in the matters of sizes and types of tools. Scattering single orders and inquiries came from railroads and concerns in the automotive industry.

NEW YORK

The situation in the Metropolitan district is about evenly divided between those concerns which report business slacking up moderately, due almost entirely to vacation influences, and those which expect July to be as good as June, and, in a few cases, perhaps a record month. The difference hinges largely around the kinds of industries served and the types of machine tools handled. The electrical plants are prominent in the buying, with General Electric and Western Electric among the larger purchasers. Sheet metal plants are likewise placing good orders. Radio industries and the railroads, principally the New York Central, are doing some buying. Airplane accessory manufacturers are an important factor in some lines of buying, and airplane plants are adding a little new equipment.

Milling machines, turret lathes, other standard machine tools and some smaller equipment are selling well. Larger equipment and small tools are not moving so fast from the standpoint of actual orders, but inquiries are still fair. In the locomotive field, inquiries for milling and facing machines are out, and there is some promise of a demand for special machine tools. A few buyers are beginning to consider the need for replacements.

While the factories are catching up on deliveries in a few lines where there has been a slight let-down in demand, in most cases no progress is being made, and the situation is growing even worse. Quotations for November and December delivery on standard lines are common. Prices evidently are not going down. One manufacturer of planers has just announced a price increase. The impression prevails that many machine tool builders may raise prices, coincident with the introduction of improvements in their products. Used machinery is sharing in the general prosperity. Equipment is hard to get, volume of sales holds up, and prices are high and firm.

Sales of equipment reported by the Triplex Machine Tool Company for the past two weeks are: One Swiss jig borer, two Oesterlein milling machines, two Mikron gear hobbers, four Springfield lathes, one Boley multiple driller and tapper, three two-spindle Edlund drill presses, six small drill presses, two Ames bench lathes, three floor power presses, one Laporte filing machine and two nibbling machines.

DETROIT

Thus far the month of July has been characterized by a general depression that has been felt throughout the entire machinery and machine tool trade of the Detroit district.

One of the few outstanding incidents has been the purchase of a large amount of machinery and equipment by the Packard Motor Car Co. for its new airplane motor plant. One firm obtained orders for approximately $150,000 worth of equipment and other smaller orders were placed elsewhere.

Some of the dealers are fairly busy, but this is not particularly significant, since most of their salesmen and office workers are taking their vacations. The orders coming in are mostly for replacement equipment and for some fixtures.

Most of the small shops doing contract jobbing are either shutting down or going on reduced schedules. A few of them are buying new tools and dies, but these are the exception. One machinery dealer reports, however, that he expects to close several good-sized orders with small shops between now and the middle of August. A few of the shops are working full time, but this is unusual.

The automobile and accessory plants as well as the body builders are all fairly busy. None of them are buying much machinery, however, and the indications are that they will not begin to do so for at least a month. There are many indications that the automobile manufacturers will begin making a number of substantial changes in August, but there seems little prospect that anything will be done before then. Should all of the expected changes be made, the last half of 1929 will be at least as profitable for the machinery and machine tool dealers as the first half has been. Should this be the case, the year will be by far the greatest in the history of the trade here.

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Morocco as a Growing Machinery and Tool Market

By Our Paris Correspondent

Records indicating the volume of American tools and machines entering the French Protectorate of Morocco show that the volume of trade is growing. In addition, many so-called French exports are transit American goods, probably less so in tools and machinery than in many other lines, but still existent. With the growing European civilization, business in volume and value is increasing annually. Machine tools and their accessories and parts pay customs dues of 12½ per cent on entering the country.

French foreign trade authorities point to the great preponderance of imports from France and comment that the "preponderance of French imports is a compliment to their low price and superior quality." The sting was eased up by the continuing phrase: "American tools are appreciated also by reason of the superiority of their fabrication." With this text in hand it may suggest to the American manufacturer that here is a market worth studying in detail on the spot. Moroccan railway construction has now about reached its end. An admirable system of highways of ten thousand kilometers or more has been put into service. Development in all aspects of modern life is due within the next ten years to an extent that it has not known in the last hundred.

Continuing comment is to the effect that Belgian and Austrian manufacturers have always known the value of the market and are pushing their wares without cease. As for Germany, the latter observation is even more true. Above all, its agricultural tractor "Lanz" is finding a ready market that none other is apparently able to compete with in point of price, and above all, power. Criticism of certain American tractors is that they are underpowered. It is not likely that transport charges overseas from American ports is any very great handicap to American trade. The same articles of metal coming from northern German ports have virtually the same distance to cover.

Morocco is believed to be a country where a standardized product will ever find a ready outlet.

Fairchild Aircraft, Limited Organized in Canada

Organization has been completed in Canada of the Fairchild Aircraft, Limited, a company with an authorized capital of $2,000,000, which has secured an area of 265 acres of land at Longueuil, Quebec, five miles from the business center of Montreal, for the establishment of an airplane factory and the creation of an airport for both land and seaplanes. The principal officers are Sherman M. Fairchild, president, and Julian C. Smith, vice-president. Mr. Smith is also vice-president and general manager of the Shawinigan Water and Power Co., and president of the Montreal Tramways Co.

The new Canadian company is an outgrowth of Fairchild Aerial Surveys (of Canada) Limited, organized in 1922, which was later changed to Fairchild Aviation, Limited. The factory which is to be built at Longueuil will measure 140 by 260 feet and, it is stated, will be one of the largest and most modern plants devoted exclusively to the manufacture of aircraft in Canada. The company will be a complete, self-contained organization with its own design staff for development of aeroplanes especially for Canadian conditions, and for export to other parts of the British Empire.

* * *

Co-Operative Movement Shows Decided Gain

The growth of the co-operative movement in American business is shown in a comparison of the latest compilation of this country's commercial and industrial organizations, just issued by the U. S. Department of Commerce. The present compilation contains the names of more than 13,000 organizations, including 2,000 national associations, about the same number of state bodies, and more than 9,100 local organizations. When the first manual of this kind was published in 1912, the total number of listings was only 3,200, of which 350 were national in scope. The total number of organizations listed in 1926, the year of the edition preceding the present one, was approximately 9,000, or about 55 per cent of the number shown in this year's edition.

* * *

Franco-German Machine Tool Competition in Poland

Germany's recent commercial accord with Poland is bearing fruit. Complaint is made by French representatives in Poland that French manufacturers in many lines are letting business get away from them. France, too, has developed very friendly liens with Poland during the last twelve months. France, however, has not given the prompt service of the Germans.

The following statement has been made by a French cabinet chief of

some of the difficulties which the government is having in endeavoring to encourage French trade abroad.

A demand for lathes of a value of 25,000 francs was submitted French makers on February 18. The French firm replied on March 5. The German firm replied on February 25 and got the business. A price was asked on a rock crushing plant of a value of 250,000 francs on February 15, the French reply being forthcoming only on May 16, whereas the German reply that got the order was dated March 5. Electric motors of a value of 50,000 francs were asked for on March 5 but no replies from France appeared before April 8 and May 11. Germany, meanwhile, had got the business on March 7. Hydraulic equipment of a value of 150,000 francs, in response to a demand of September 10 got a reply from France on December 6, the order meanwhile having gone to Germany on October 11.

The lesson for American exporters in this is that if working out of France, or for that matter anywhere else in Europe, in an effort to secure Old World trade, an American efficiency salesman connected with the representing firm would often bring business which otherwise might go by the board through neglect. The European market today is more or less hand-to-mouth and it is also more or less hair-trigger. And Germany is good on the trigger.

* * *

Plan Industrial Museum At Swatow, China

The Christian Institute, an American endeavor at Swatow, China, is planning the establishment of an industrial museum in that city, and models of modern industrial plants and machinery are very much desired. According to Dr. Speicher of the Institute, the peasants of the Swatow area could produce annually thousands of tons of paper pulp made from bamboo, and many other products, in proportion, if the machinery and methods were available. American firms interested in supplying models may gain further information from the Bureau of Foreign and Domestic Commerce at Washington.

* * *

Eastern Exposition Plans Progressing

Space reservations for the 13th annual Eastern States Exposition to be held in Springfield, Mass., September 15 to 21, indicate that this will be the largest exposition yet held. In the industrial arts section a large number of industrial and commercial concerns located outside the eastern territory, but selling in that territory, are applying for space. Last year there were 325 exhibitors in the industrial arts division, which represents one of the major departments of the exposition. Of the total number of exhibitors 28 per cent were drawn from points outside New England and of the remaining more than one-fifth comprised exhibits arranged by direct New England factory branches of national manufacturers.

* * *

Canadian Imports Increase 29 Per Cent

Canadian imports increased about 29 per cent in May, goods totalling $125,615,364 being imported during the month. This is an increase of 10.6 per cent over a year ago. Exports increased 64 per cent over the previous month, but declined 8.9 per cent from a year ago during the same month. The exports for the month were $107,472,827. During the same month the automobile output declined substantially, after new high production records had been made.

Business Items

The Combustion Engineering Corporation, New York, has announced various changes in the southern territory, dividing the Atlanta district into three separate districts with offices in Atlanta, Charlotte, N. C., and New Orleans. T. W. Battle is in charge of the Charlotte branch; I. S. Forde is acting district manager in Atlanta, succeeding T. J. Cleary, resigned, and E. C. Walthall is manager at New Orleans.

The Jaffe Machinery Exchange now occupies a specially constructed four-story building at 6545 Waverley Street, Montreal. Besides being considerably larger, these new quarters provide better and more adequate facilities for dealing in used contracting equipment and mining machinery. Recently the company purchased the Nicholls Chemical Company's plant at Goudreau, Ontario.

The Grapho-Metal Packing Co., Indianapolis, has purchased the Detroit Replacement Service, Detroit, and will move them to Indianapolis in the near future. The Indianapolis company makes Graphic water-pump packing, while the Detroit firm manufactures water pumps and starting cranks.

The George B. Miller & Son Co., Waterloo, Iowa, agricultural implement firm, was reorganized recently with the election of C. J. Ness, head of the C. J. Ness Pattern Co., as president; E. H. Headford, president of Headford Bros. & Hitchins, as vice-president, and Frank J. Hadish as secretary-treasurer.

The Remington Arms Co. has recently acquired the exclusive manufacturing rights for a new accounting machine invented by Rolf Hafgaard. Mr. Hafgaard controls the majority of the stock in the holding company known as the Hafgaard Remington Corporation.

Important extensions to the plant of the Hull Iron and Steel Foundries, Ltd., Hull, Quebec, have been announced by A. H. Coplan, president of the company, who states that the improvements contemplated involve the expenditure of $200,000. Included in the expansion program is the erection of a four-story addition to the main building. The extension to the main plant will be used for the manufacture of steel side frames and steel bolsters for freight and passenger steam railways, according to standards established in Canada and the United States.

The Herman Body Co., St. Louis, manufacturer and distributor of automobile truck bodies, is preparing to open a branch plant in Decatur, Ill., and according to Herman E. Plew, president, expects to have the unit in operation by August I. Parts will be shipped there for assembly, for the present at least, it is understood.

Walsh & Weidner, Chattanooga, Tenn., subsidiary of the Combustion Engineering Co., New York, awarded contracts recently for a large addition to the machine shop unit, it was announced a few days ago by an official for the company. The new unit will be one story in height and will occupy a site of about 200 by 60 feet.

The Linde Air Products Co., New York City, is now producing oxygen in a new plant located at 2603 Floyd St., Louisville, Ky. Mr. Frye is superintendent of the plant and W. L. Fox, whose headquarters are at the Cincinnati Linde plant, is district superintendent.

The Walker Stewart Foundry Corporation, Southington, Conn., has incorporated, and will carry on operations in the Plantsville plant. Victor E. Walker was president of the old company and is an incorporator of the new organization. The other incorporators are: Thomas W. Thomson, Plantsville, and Samuel Botwinik, New Haven.

The Ingersoll-Rand Co., manufacturers of machinery and tools for railroads, mines, and public utility corporations, has leased 4,000 sq.ft. of space in the new Daily News Building, Madison and Clinton Streets, Chicago, to which it will remove its general offices from its present location on Michigan Avenue.

The Automatic Heater & Power Co. was organized recently at Birmingham, Ala., and has established headquarters at 1701 Avenue A, that city, as distributors in the southeastern territory for the Iron Fireman automatic coal burner and similar industrial equipment and machinery.

The K. B. Auto-Radio Laboratories Inc., Chicago, has leased a factory-garage building at 2925 Calumet Ave., for a term of three years. The company, which specializes in the building of radio sets for automobiles exclusively, will use the building for the manufacture of its products.

The Biflex Products Corporation will build a new forge building, 150x160 ft., north of its present Decatur, Ill., unit, scheduled to be completed in two months, according to A. J. Grimm, vice-president

of the company. When it is completed, the Biflex plant in the 800 block on West Garfield Street, will cover an area of 760x150 ft. with 114,000 sq.ft. of floor space. The new plant will cost $50,000. New equipment to the value of $100,000 will be installed and the unit prepared for the transfer of bumper manufacture from the Waukegan plant to Decatur. R. F. Peterson, plant manager, arrived this week from Waukegan.

The Ebbert & Kirkman Co., Inc., Birmingham, Ala., machinery and machine tool distributor in the southeastern territory, has been appointed sales representative in that district by the Hill-Clutch Machine & Foundry Co., Cleveland, Ohio, manufacturer of power drive equipment and special machinery.

The West Point Iron Works, West Point, Ga., manufacturers of machinery and distributors of various machinery and machine tool lines in the southeastern territory, awarded contracts recently for the construction of a substantial addition to the company's present plant.

The Central Foundry Co., Birmingham, Ala., founder and machinery manufacturer, will start at once the construction of an addition to the foundry and machine shops that will give the plant an increase in capacity of about 4,000 sq.ft. of floor space.

Allied Motor Industries, Inc., has purchased the former Wills-Ste. Claire automobile factory at Marysville, Mich., according to W. R. Wilson, president of Allied Motor Industries. The purchase includes 144 acres of land and 3,400 ft. of frontage on the Ste. Claire River.

The Mueller Engineering Works, Inc., Racine, Wis., plans to take over the hydraulic jack and automotive equipment business of J. J. Mueller and associates. The company has leased about 10,000 sq.ft. in Racine and will greatly enlarge its capacity in the near future.

The Midland Steel Products Co., Cleveland, Ohio, has just completed an investigation which, it is claimed, indicates that the new research laboratory belonging to the company has saved the automobile industry $375,000 in two months.

The Tractor & Machinery Co., Inc., 351 Whitehall St., S.W., Atlanta, announced a few days ago that the company had been appointed distributors in the Georgia district for the Ryan motor-controlled grader, manufactured by the Ryan Manufacturing Co., Chicago, Ill.

The Jensen Radio Manufacturing Co., formerly of Oakland, Calif., has added 43,103 sq.ft. to its holdings in the Clearing Industrial District of Chicago, and will erect another plant to double its capacity.

The Klein Manufacturing Co., formerly the Northwestern Stamping Co., Burlington, Iowa, which in addition to its hardware specialties lines is now one of the largest producers of poultry equipment, has broken ground for a $30,000 plant addition, 160x108 ft. The plant will have a total floor space of 49,680 sq.ft. New machinery and equipment at a cost of $10,000 will be installed later, Arthur J. Klein, secretary-treasurer announced.

The Manufacturers Finishing Co., Inc., Bristol, Conn., has recently been established in Waterbury, Conn. The new firm will engage in electroplating and certain forms of brass goods finishing.

The American Brass Co., subsidiary of the Anaconda Copper Co., Waterbury, Conn., has purchased the Randolph Cowles Co. of that city, manufacturers of brass and copper tubing and boiler products.

The Newhall Chain Forge & Iron Co., New York, has purchased the Rensselaer Chain Works, Rensselaer, N. Y. The Newhall Chain Forge & Iron Co. is a division of the Henry B. Newhall corporation, Garwood, N. J.

Canadian Sprucolite, Ltd., which recently purchased the plant of the Partridge Tire and Rubber Co. at Guelph, Ont., has just completed extensive operations and additions to this property, and active production is now under way.

The Briggs and Stratton Co., Milwaukee, Wis., manufacturer of automotive switches and other metal specialties, is manufacturing a new type of cylindrical padlock for the McKinney Hardware Co., Pittsburgh, Pa.

The International Molding Machine Co., with the purpose of expanding its manufacturing resources,, has bought a piece of land, 75x124 ft. adjoining its factory at 2616 West Sixteenth Street, Chicago.

The Great Neck Manufacturers, Inc., has established a sales office at 162 Chambers St., New York. The company manufacturers Monarch hacksaw blades.

Gane Bros. & Lane, Inc., Chicago, manufacturers of book-binding machinery, will erect a 3-story factory building on a 50x150-ft. site in that city, which they have recently purchased.

The Akron Foundry Co., Akron, Ind., has filed articles of incorporation, and is planning the erection of a 66 x 100 ft. factory building to be in operation by August 1.

The Bristol Co. of Waterbury, Conn., has started work on a new one-story factory building at the Waterbury plant, to be used by the hardening department.

The Viking Sea Boat Corporation will soon start the manufacture of F.B.A. French amphibian planes in Winchester, Conn.

The Electric Auto Lite Co., Toledo, Ohio, is negotiating for the purchase of the John W. Brown Co., Columbus, Ohio, large auto lamp and accessory manufacturer, according to C. O. Miniger, president of the Toledo concern. The Electric Auto Lite Co., also controls the Columbus Auto Parts Co., on Hudson St.

The National Industrial Advertisers Association will hold its eighth annual convention in Cincinnati, Ohio, on September 30, October 1 and 2.

The Automotive Fan & Bearing Co., Jackson, Mich., has purchased a 9-acre tract upon which it contemplates building an addition.

The Austin Welding Works, Inc., Chicago, has been incorporated to manufacture and deal in tools and similar equipment.

The Aeronautical Chamber of Commerce of America, Inc., has opened new offices at 10 E. Fortieth St., New York City.

The National Association of Manufacturers will meet at the Roosevelt Hotel, New York City, October 14-16.

William Collins & Son, Halifax, N. S., is building a 2-story machine shop to increase the capacity of the present plant.

Personals

E. A. WEAVER, district manager Boston office, The Surface Combustion Co., is to be transferred to the home office in Toledo, Ohio. Mr. Weaver will have charge of sales promotional work, primarily of standard equipment which covers the complete line of Surface Combustion gas, home heating conversion burners, S. C. standard furnaces, appliances and industrial burner equipment. JOHN R. WALTMAN, who has been attached to the home office of the same company in a sales supervisory capacity, will be transferred to the Boston office as district manager. The New England District office will be maintained in the building of the Boston Consolidated Gas Company, Boston, Mass.

ROBERT W. LEA, president of the Moline Implement Co., Moline, Ill., prior to its merger with the Minneapolis-Moline Power Implement Co. of which he was vice-president and director, has resigned and will become associated with the industrial department of a New York financial house. HAROLD B. DINEEN, former vice-president of the Moline Implement, who becomes vice-president and director of the Minneapolis-Moline concern, will succeed Mr. Lea.

CHARLES GORDON, editor of *Electric Railway Journal*, a McGraw-Hill publication, was selected to succeed Lucius S. Storrs as managing director of the American Electric Railway Association at a meeting of the subcommittee of the Advisory Council held in New York City on July 9. The appointment was

confirmed by the Executive Committee of the association at its meeting on July 12. Mr. Gordon will assume his new duties on September 1.

H. Wilson has been made superintendent of the Wichita, Kan., plant of the Prest-O-Lite Co., Inc., which commenced operations on June 28. W. Webert is district superintendent with offices at North Kansas City. A. C. Mattison is superintendent of the Youngstown, Ohio, plant of the same company, which commenced operations on July 3. C. G. Holt is district superintendent of that district, with headquarters at Pittsburgh.

George A. Pugh, has been elected vice-president of the Aetna Standard Engineering Co., Youngstown, Ohio, and will be in charge of machinery sales. H. E. Melin has been appointed assistant manager of machinery sales. M. D. Baughman, has been appointed manager of the operating department and will have charge of plants in Warren, Ohio, and Ellwood City, Pa.

Joe G. Belding, who for the past 11 years has been general manager of the Lombard Iron Works & Supply Co., Augusta, Ga., was elected president of the company at the annual meeting of the board of directors this month. He succeeds the late George R. Lombard, founder of the company, who died recently.

P. H. Noland who was vice-president of the Moline Implement Company, Moline, Ill., prior to its recent inclusion in the Consolidated Company of Minneapolis, with which the Moline Implement was merged, has resigned. He will be identified with the Consolidated Company in an executive capacity in the main offices in Minneapolis.

H. W. Newton, for several years connected with the Stephens-Adamson Manufacturing Co., Aurora, Ill., has been appointed manager of the southeastern branch of the company at Birmingham, Ala., succeeding W. E. Harris.

J. A. Bohannon, former vice-president of the Marmon Motor Car Co., Indianapolis, has resigned to become president of the Peerless Motor Car Co., Cleveland. Mr. Bohannon joined the Marmon company as purchasing agent in 1922.

Edgar S. Gorrell, president of the Stutz Motor Car Co., Indianapolis, was the only Indianapolis person to board the first plane of the T.A.T. when it stopped there enroute from New York to the west coast. Col. Gorrell was honored with a reservation in the first plane from a list of 1,500 requests.

Dr. Albert Sauveur, professor of metallography and metallurgy in Harvard University, has accepted the invitation of the board of directors of the American Society for Steel Treating to present the E. D. Campbell Memorial Lecture for 1929. The lecture was established by the directors of the society to perpetuate the memory of its honorary member, Dr. Edward D. Campbell of the University of Michigan. Dr. Sauveur's lecture will be presented on Wednesday morning of the National Metals Congress, which will be held during the week of September 9, in Cleveland.

George W. Zinky heads a group of Muskegon business men who are to operate the Panyard Machine & Manufacturing Co., Muskegon. He was formerly executive vice-president of the Union National Bank, Muskegon.

John North Willys, former president of the Willys-Overland Co., Toledo, Ohio, resigned his post on July 16 to become chairman of the board of that company. Linwood A. Miller, first vice-president, succeeds Mr. Willys as president.

J. Olson has been appointed superintendent of the Hilles & Jones Works, Wilmington, Del., of the Consolidated Machine Tool Corporation, Rochester, N. Y.

A. J. Vondersaar heads the newly-formed Automatic Screw Products Corporation, Indianapolis. W. H. Vondersaar has been elected secretary-treasurer.

G. W. Foote has been appointed factory manager of the Perfex Corporation, according to an announcement made by D. T. MacLeod, president. Mr. Foote was formerly general superintendent for the Republic Metalware Co., Buffalo.

Warren C. Webb has been appointed Pacific Coast sales manager for the W. A. Jones Foundry & Machine Co., Chicago. His offices will be at 443 East Third St., Los Angeles.

Obituaries

Harris Botwinik, president of the Harris Iron & Metal Co., Inc., and Botwinik Bros., Inc., machinery dealers, New Haven, Conn., died on July 12 of heart disease. He was 57 years of age, and came from Russia at the age of 16.

Irving J. Budlong, former head of the American Woodworking Machinery Co., and vice-president of the Merchon Manufacturing Co., Saginaw, Mich., died June 17 at Saginaw at the age of 60.

Frederic H. Poor, head of Frederic H. Poor, Inc., 50 Church St., New York, manufacturer and distributor of tractor cranes and allied products, died on July 9 at Yonkers, N. Y. He was 47 years of age.

William Yates, superintendent of the Heppenstall Forge & Knife Co., Pittsburgh, died July 14. He was 77 years of age and had been with the company for the past 50 years.

John S. Turner, long a prominent figure in railroad circles, former superintendent of motive power of the Southern Pacific and Virginia Central railroads, and for the past 25 years with the Pressed Steel Car Co., died on July 15 after a short illness.

George T. Chaffee, part owner of the Patch Wegner Co., machinery manufacturer, and a director of the Glens Falls Machine Co., died July 15 at his home in Rutland, Vt. Mr. Chaffee was 71 years old and was also prominent in banking circles and in the lumber business.

Herman Markowitz, president of the Aetna Stove Co., Philadelphia, died recently in that city. He was 61 years of age, and had founded the stove company in 1890.

Franklin W. Mahar, head of the Mahar Machinery Co., Inc., 90 West St., New York, died July 4 at Columbus, Ohio, after a short illness. He was 49 years of age.

John D. Case, founder of the firm of Case Brothers Cutlery Co., Little Valley, N. Y., died at his home there on July 15. He recently celebrated his seventy-first birthday.

Forthcoming Meetings

National Metal Congress. To be held in Cleveland September 9 to 13. Simultaneous meetings of the American Welding Society, the Institute of Metals Division, American Institute of Mining & Metallurgical Engineers, Iron & Steel Division, American Society of Mechanical Engineers, the Iron & Steel Division, A.I.M.E., and the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

National Metal Exposition. Eleventh annual, held under the auspices of the American Society for Steel Treating, Cleveland Public Auditorium, Cleveland, Sept. 9-14. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

American Railway Tool Foremen. Annual convention at Hotel Sherman, Chicago, September 11 to 13. C. C. Ziegler, secretary-treasurer, 611 West Washington Blvd., Chicago.

Machine Tool Builders Exposition. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati.

Society of Industrial Engineers. Sixteenth national convention at Hotel Statler, Cleveland, October 23 to 25. Requests for programs should be sent to S.I.E. national office, 205 West Wacker Drive, Chicago.

THE WEEKLY PRICE GUIDE . . . S

Rise and Fall of the Market

IRON shipments are reaching record proportions, while at the same time, demand for steel continues unseasonally strong in all lines. Buying is particularly active in requirements for the following industries: Construction, railroads, automotive, oil and gas pipe lines, and agricultural implements. Second-quarter steel prices have held throughout July with a few exceptions, such as the rise of 10c. per 100 lb. in New York warehouse quotations on cold-finished shafting and screw stock. Linseed oil is advancing rapidly, with possible effect on cost of paint. Raw oil at New York is now 13.3c. per lb., against 11.7c., July 5. Lead is off ¼c. per lb. (6.55c.) at East St. Louis; antimony declined ¼c. per lb. (11c.) at New York and ¾c. (12¼c.) at Cleveland warehouses.

(All Prices as of July 19, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	20.75
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	24.79
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20 00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.76
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.76
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20@2.35	3.35	3.30	3.90†
No. 12	2.25@2.40	3.45	3.35	3.95†
No. 14	2.35@2.50	3.55	3.45	4.00†
No. 16	2.45@2.60	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.65@2.75	3.85	3.70	3.80
No. 22	2.80@2.90	4.00	3.85	3.95
No. 24	2.85@2.95	4.05	3.90	4.00
No. 26	2.95@3.05	4.15	4.00	4.10
No. 28	3.10@3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.60@3.70	4.90	4.75	4.75
No. 26	3.75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.60	3.65	3.60
Cold drawn, flat or square‡	4.10	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.25	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ¼, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.50
Lead, pigs, E. St. Louis	6.55	New York	8.12½
Zinc, slabs, E. St. Louis	6.80	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.00	12.25	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	19.87½	19.87½	19.87½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	11.00	11.70	10.11
Solder (½ and ½).....	32.50	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			62.00
Commercial genuine, intermediate grade.....			45.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	15.25 @15.50	13.50	13.00 @14.00
Copper, heavy, and wire..	14.00 @15.25	13.00	12.00 @13.00
Copper, light, and bottoms	12.50 @13.25	12.50	11.00 @12.00
Heavy lead.....	5.12½@ 5.37½	6.25	5.00 @ 5.50
Tea lead.....	3.50 @ 4.00	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	8.50 @ 9.00	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	7.00 @ 7.50	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.50 @10.00	9.00	10.00 @10.50
Zinc.....	3.25 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.133	.11	.117
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.75	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.036	.035	.034
Brass rods.....	per lb..	.2125	.2125	.17
Solder (½ and ½).....	per lb..	.325	.3225	.31
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.75	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		3.00@3.50
Coke, prompt foundry, per net ton...	Connellsville,		4.00
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, ⅞-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mass., Boston—W. M. Corbett, Fenway and Kilmarnock Sts.—miscellaneous tools and equipment for proposed 1 story, 100 x 120 ft. garage and repair shop. Estimated cost $60,000.

Mass., Medford — Ripley Co., 111 Ashcroft Rd.—drilling outfit compressor, drills, tubing, etc.

Mass., Waltham (Boston P. O.)—Cedar-Crest Farms, Trapelo Rd.—circular saw with adjustable table for splitting timbers and planks up to 10 in. thick.

Mich., Detroit—Greyhound Lines, Inc., Tuller Hotel—machine equipment for proposed 1 story, 115 x 370 ft. garage and repair shop on Fort St. Estimated cost $125,000.

Mich., Detroit—Majestic Tool & Mfg. Co., 2650 Poplar St.—shaper.

Mich., Detroit—Michigan Bell Telephone Co., Cass Ave.—garage and shop equipment for proposed 300 x 340 ft. central warehouse and garage on Oakman Blvd. Estimated cost $1,500,000.

O., Columbus—Capitol Die Tool & Machine Co., 446 East Fifth Ave., R. B. Ralston, Mgr.—two lathes 24 in., automatic machine, drill press, etc., for proposed addition to plant.

O., Sciotoville—Gallia Motor Co., O. C. Rutit, Pres.—drill press, automatic machine, valve grinder, air compressor, etc. for proposed addition to service station.

Pa., Monaca—Pittsburgh Tube Co.—new cranes, furnaces and other equipment for proposed factory. Estimated cost $500,000.

Tex., San Antonio—Roth Bros., North Flores St.—machinery and equipment for general auto repairing, etc., for proposed 3 story garage. Estimated cost $100,000.

Tex., San Antonio—Yellow Cab Co., Dolores Ave.—machinery and equipment, including lathes, drills, body equipment, etc., for proposed 1 story, 140 x 160 ft. garage.

Ont., North Bay—City Council—machinery and equipment for woodworking and machine shops, mechanics room, etc. for proposed vocational school. Estimated cost $350,000.

Opportunities for Future Business

Ark., Texarkana—Southwestern Transportation Co., c/o W. D. Russell, Gen. Mgr., 915 Rector Bldg., Little Rock, awarded contract for a bus terminal including repair shops, sheet metal iron building, etc., here. Estimated total cost $150,000.

Calif., Berkeley—California Corrugated Culvert Co., 5th and Parker Sts., awarded contract for a 1 story addition to factory. Estimated cost $40,000.

Calif., Emeryville—Merchant Calculating Machine Co., is having plans prepared for a 2 story factory on Powell St. Estimated cost $50,000. Miller & Warnecke, 1404 Franklin St., Oakland, Archts.

Conn., Hartford—Liner-Atwell Co., 69 Bartholomew Ave., will soon award contract for a 2 story, 50 x 100 ft. factory for the manufacture of cornices, skylights, ventilators, gutters and conductors. Estimated cost $65,000. C. Malmfeldt, 15 Lewis St., Archt.

Conn., Stamford—Yale & Towne Mfg. Co., 200 Henry St., will build a 1 story foundry at Canal and Market Sts. Estimated cost $55,000. Private plans.

D. C., Washington—D. C. Government, will receive bids about Aug. 1 for auto repair shop, garage, offices, etc. at Bryant St. pumping station. Estimated total cost $210,000.

Ill., Chicago—Chicago Screw Co., 1026 South Homan Ave., awarded contract for masonry, etc., for a 4 story, 70 x 124 ft. addition to machine shop at 3448 Fillmore St. Estimated cost $100,000. Noted Apr. 25.

Ill., Rockford—Rockford Drop Forge Co., had plans prepared for a 1 story, 85 x 274 ft. factory. Estimated cost $150,000. Lockwood, Greene & Co., 400 North Michigan Ave., Chicago, Archts.

Ind., Fort Wayne—Fisher Bros. Paper Co., awarded contract for a 70 x 150 ft. machine shop and service station at Lafayette and Main Sts. Estimated cost $65,000.

Ind., Elwood—Elwood Box Co., awarded contract for the construction of a factory. Estimated cost $46,000.

Ind., Muncie—Warner Gear Co., awarded contract for a 1 story 150 x 400 ft. factory at Seymour St. Estimated cost $75,000.

Ia., Burlington—Burlington Basket Co., E. A. Florang, Pres., will build a 2 story factory. Estimated cost $100,000. Work will be done under the supervision of F. Schroeder of Management Service Co., 110 South Dearborn St., Archt.

Kan., Emporia—Atchison, Topeka & Santa Fe R.R., Topeka, awarded contract for a 1 story, 24 x 77 ft. shop, 1 story, 24 x 174 ft. garage, etc. here. H. W. Wagner, Ch. Engr.

Mass., Chelsea—Inter-Continental Pipe & Mining Co., H. Kennedy, Pres., 475 5th Ave., New York, N. Y., is having preliminary plans prepared for the construction of a plant on Eastern Ave. Estimated cost $3,000,000. Fay, Spofford & Thorndike, 44 School St., Boston, Engrs. Noted May 24.

Mass., Everett (Boston P. O.)—Henry T. Ripley, Inc., 80 Boylston St., Boston, plans the construction of a 1 story steel factory. Private plans.

Mass., Fairhaven—Fairhaven Iron Foundry, 2 Water St., awarded contract for rebuilding iron foundry destroyed by fire, 1 and 2 story, 50 x 100 ft. Estimated cost $40,000. Noted May 30.

Mich., Detroit—Bohn Aluminum & Brass Co., Jos. Campau Ave., awarded contract for a 3 story, 110 x 145 ft. airplane parts factory. Estimated cost $130,000.

Mass., Middleboro—Maxium Fire Engine Co., C. L. Maxium, Pres., manufacturers of ladders, apparatus and engines, is having plans prepared for a 3 and 4 story addition to factory. Private plans.

Mass., West Springfield (br. Springfield)—Boston & Albany R.R. Co., South Station, Boston, is having plans prepared for additions to shops here. Estimated cost $500,000. G. A. Kirby, Boston, Ch. Engr.

Mich., Detroit—University of Detroit, Livernois Ave. and Six Mile Rd., is having plans prepared for a 1 and 2 story aeronautical laboratory and machine shop. Estimated cost $75,000. Architect not selected.

Mo., Kansas City—City is having sketches made for the construction of an air terminal including circular shops, etc. Estimated cost $500,000. Buckley & Van Brunt, 823 Gloyd Bldg., Archts.

Mont., Havre—Great Northern Ry. Co., Railroad Bldg., St. Paul, Minn., awarded contract for a 1 story round house, etc. here. Estimated cost $65,000. J. R. W. Davis, St. Paul, Ch. Engr.

N. J., Newark—E. C. Epple, 44 Commerce St., Asso. Archt., is receiving bids for a 3 story, 200 x 206 ft. factory at Central Ave. from 16th to 17th Sts. for Packard Motor Car Co., Broadway and 61st St., New York. Estimated cost $300,000. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt. Noted July 4.

N. Y., Brooklyn—Lipso Realty Co., S. Pipoff, Pres., 843 Ocean Ave., will build a garage and repair shop, etc. at 8th Ave. and 61st St. Estimated cost $40,000. I. Kallich, 36 Court St., Archt.

N. Y., Hempstead—Quartermaster General's Office, Construction Div., Washington, D. C., will soon award contract for the construction of a group of buildings, including four hangars, machine shop, etc., at Mitchell Field.

N. Y., Laurel Hill (mail Flushing)—Nichols Copper Co., Halle and Hobson Sts., awarded contract for the construction of a factory. Estimated cost $40,000. July 11.

N. Y., New York—New York Central R.R., 466 Lexington Ave., awarded contract for the construction of a garage, service station, etc., at West End Ave. between 65th and 66th Sts. F. B. Freeman, Ch. Engr. Noted May 30.

N. Y., Tarrytown—Chevrolet Motor Co., 3044 West Grand Blvd., is having plans prepared for the construction of a plant. Estimated cost $1,500,000. A. Kahn, Inc., 1000 Marquette Bldg., Detroit, Mich., Archt.

O., Cleveland—Bender Body Co., H. Bender, Pres., 6401 Barberton Ave., awarded contract for 1 story, 99 x 144 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Gravity Carburetor Co., 3062 East 93rd St., awarded contract for a 1 story, 40 x 100 ft. addition to factory. Estimated cost $40,000. Noted May 16.

O., Cleveland—Reliance Electric & Engineering Co., C. L. Collins, Pres., 1088 Ivanhoe Rd., awarded contract for a 1 story, 150 x 180 ft. factory. Estimated cost $100,000.

O., East Liverpool—Patterson Steel Products Co., awarded contract for a 100 x 180 ft. factory. Estimated cost $150,000.

O., Youngstown—Genfire Steel Co., awarded contract for a 4 story, 60 x 200 ft. warehouse. Estimated cost $200,000.

Okla., Henryetta—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., awarded contract for the construction of a factory including shops, etc. here. Estimated cost $2,000,000.

Ore., Linnton—Clark & Wilson Lumber Co. will build a saw mill on Willemette River. Estimated cost $40,000.

Pa., Aliquippa—Jones & Laughlin Steel Co., 311 Ross St., Pittsburgh, awarded contract for 81 coke ovens, by-products and benzoil extensions, coal and coke handling equipment, etc. here.

Pa., Dravosburg—Airways and Aircraft Co. of America, Farmers Bank Bldg., Pittsburgh, is having plans prepared for airport improvements including hangars and repair shops, etc., at Bettis Field here. K. Franghein, Madison Ave., New York, Archt. J. H. Swem, 1006 Benedum Trees Bldg., Pittsburgh, Engr. Stone & Webster, Inc., Union Trust Bldg., Pittsburgh, Superv. Engrs.

Pa., Philadelphia—I. Fischman & Son, 10th and Allegheny Sts., manufacturers of soda fountains, plans a 1 and 2 story, 375 x 480 ft. plant at Erie and F. Sts. Estimated cost $1,500,000. C. E. Wunder, 1520 Locust St., Archt.

Pa., Philadelphia—Hess-Bright Co., Front and Erie Sts., manufacturers of ball-bearings, awarded contract for the construction of a 1 story, 60 x 140 and 60 x 122 ft. addition to factory. Estimated cost $100,000.

Pa., Philadelphia—C. E. Oelschlager, 1615 Walnut St., Archt., will soon receive bids for a 2 story, 50 x 150 ft. shop at 232 Vine St. for Schuch Machine Co., 235 New St.

Pa., Pittsburgh—Keystone Box Co., 28th and Smallman Sts., awarded contract for a 3 story, 50 x 100 ft. factory. Noted June 20.

Pa., Pittsburgh—U. S. Radiator Corp., Union Bank Bldg., awarded contract for the construction of a 1 and 2 story factory at 941 Behan St. Estimated cost $65,000.

Tenn., Chattanooga—Standard-Coosa-Thatcher Co., 18th St., plans addition to machine shop at 18th and Watkins Sts.

Tenn., Memphis—F. B. Wilby, in charge of Memphis Dist. corps of engineers, U. S. Army, awarded contract for the construction of a shop and warehouse.

Tex., Abilene—City is having plans prepared for the construction of an airport including hangars, machine shop, etc. Estimated cost $100,000. B. Russell Shaw Co., St. Louis, Mo., Engr. Noted July 4.

Tex., Brownsville—Pan-American Airways, Inc., c/o G. L. Reil, V. Pres., will soon award contract for a 120 x 120 ft. airport including shop. E. L. Odell, Engr.

Tex., San Antonio—Guggenheim Interests, c/o Chamber of Commerce, plans the construction of an airplane factory. Estimated cost $250,000.

Wis., Milwaukee—Wrought Washer Co., 46-54 South Bay St., awarded contract for a 2 story, 75 x 140 ft. factory. Private plans.

Wis., Waukesha—Quality Aluminum Casting Co., awarded contract for a 1 and 2 story, 88 x 105 ft. addition to factory.

B. C., Vancouver—W. E. Boeing, Hoge Bldg., Seattle, Wash., H. S. Hoffar, 1727 Comox St., and C. G. Beeching, Vancouver, plan converting Hoffar-Beeching shipyards into airplane factory, also constructing new building.

Ont., Chippewa—Canadian Ohio Brass Co., awarded contract for a 1 story addition to factory for the manufacture of equipment for transmission and electrical lines. Estimated cost $75,000.

Ont., Galt—Dominion Tack & Nail Co. Ltd., manufacturers of metal and wire merchandise, plans the construction of a plant.

Ont., Oshawa—Skinner Co. Ltd., Gananoque, plans a 1 story, 100 x 400 ft. factory for the manufacture of automobile bumpers at Simcoe St. S. here. Estimated cost $160,000. R. H. Bishop, Roger Miller Bldg., Toronto, Archt. Noted June 6.

Ont., Simcoe—American Can Co., W. E. Taylor, Gen. Mgr., is having plans prepared for the construction of a factory on Norfolk St. Estimated cost $500,000. W. Preis, c/o owner, Engr.

Que., Milnikek—Matapedia Lumber Co., Ltd., plans the construction of a mill. Estimated cost $75,000.